Aviation Week
and Space Technology
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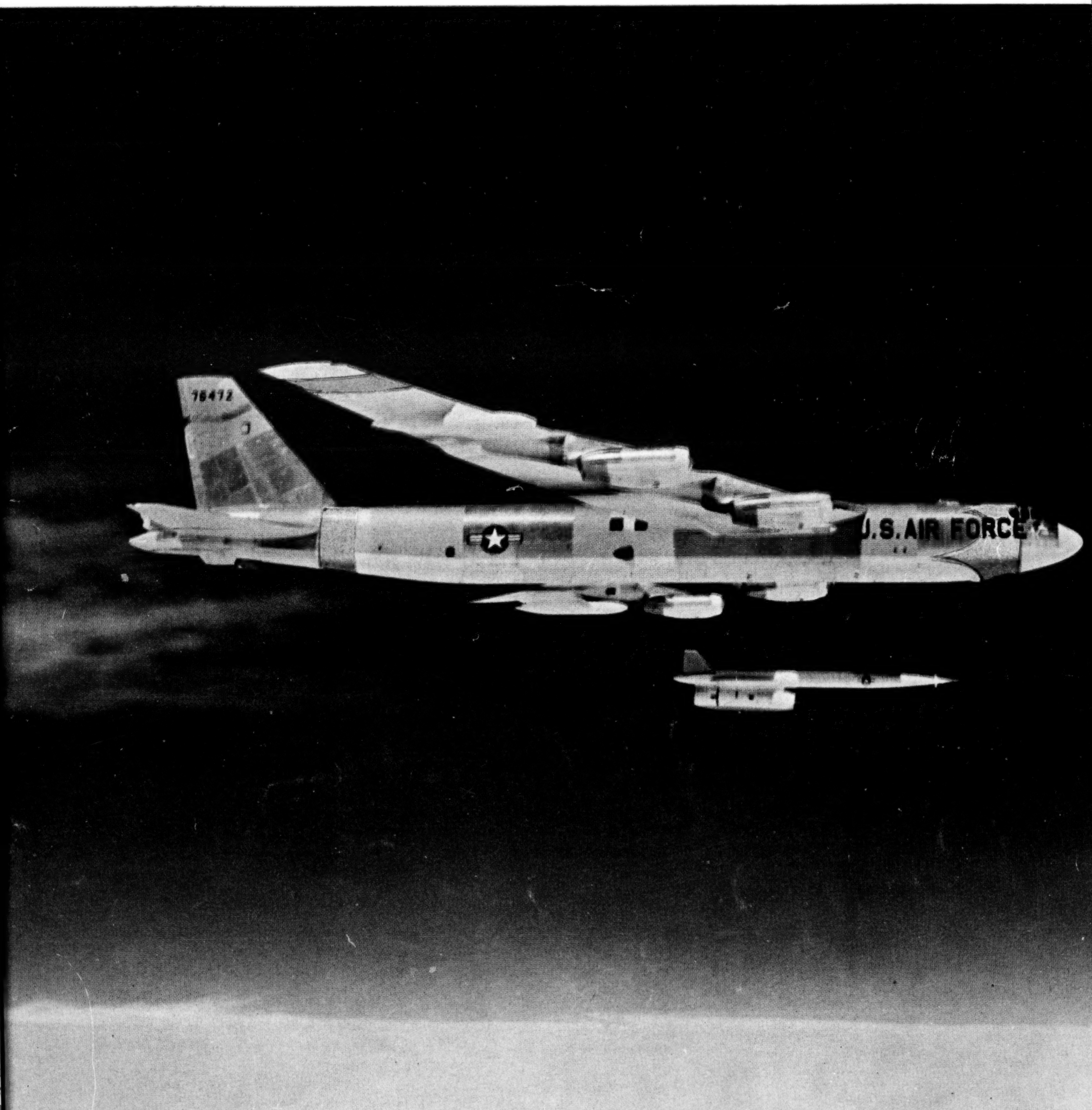
August 28, 1961

Orbital Vehicle Data System In Development

B-52G Launches Hound Dog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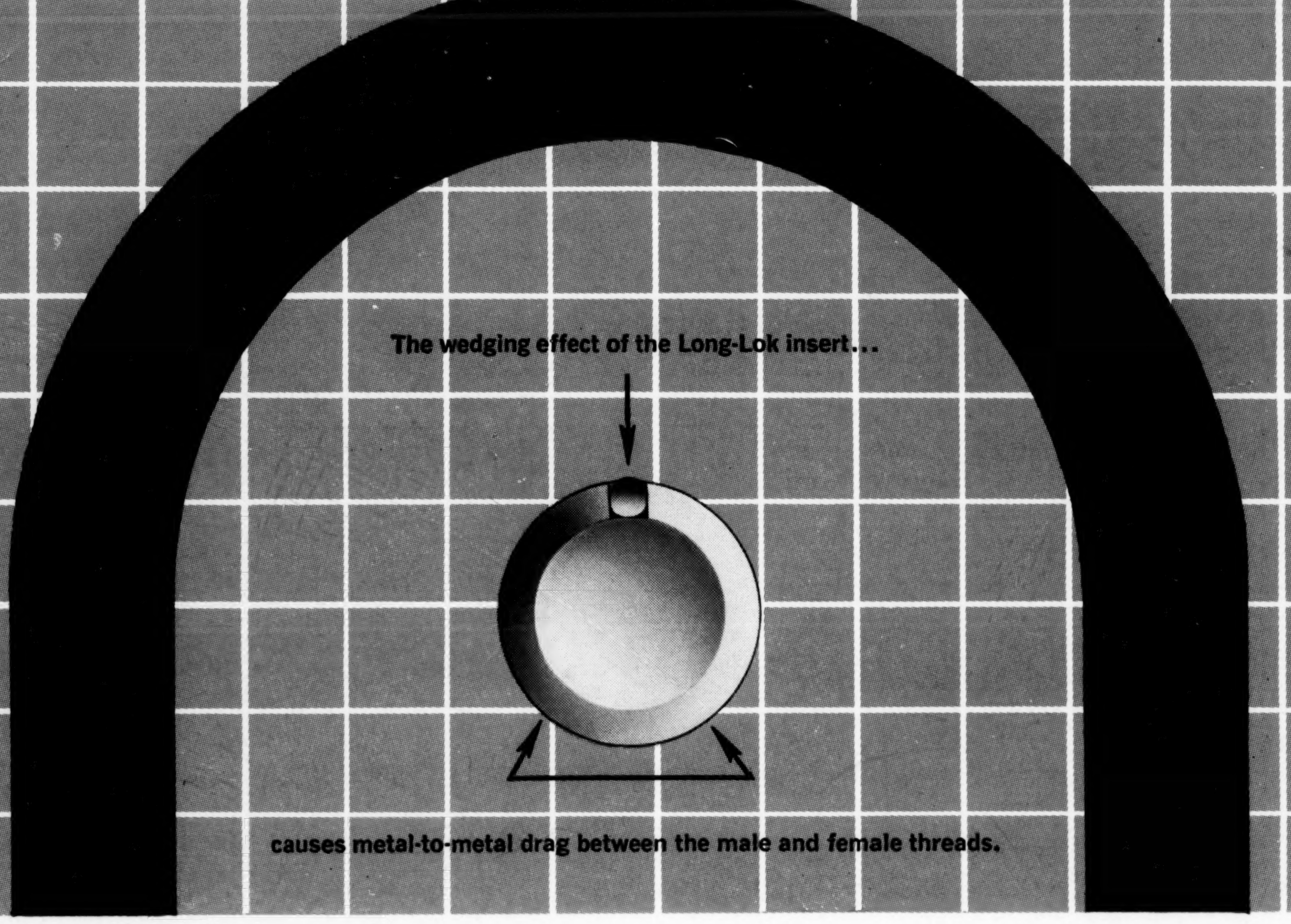
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AVIATION CALENDAR

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Sept. 4-14—Eighth Anglo-American Aeronautical Conference, Royal Aeronautical Society and Institute of the Aerospace Sciences, London, England. Wilbur Wright Memorial Lecture, Sept. 12.

Sept. 5-8—16th National Conference, Assn. for Computing Machinery and First International Data Processing Exhibit, Statler-Hilton Hotel, Los Angeles, Calif.

Sept. 5-8—Fourth Annual Scientific Meeting Flying Physicians Assn., Holliday Hotel, Reno, Nev.

Sept. 6-8—National Symposium on Space Electronics and Telemetry, Institute of Radio Engineers, University of New Mexico, Albuquerque, N. M.

Sept. 6-8—Joint Nuclear Instrumentation Symposium, North Carolina State College, Raleigh, N. C. Sponsors: American Institute of Electrical Engineers; Instrument Society of America; IRE.

Sept. 7-8—Fall Meeting, Western States Section/The Combustion Institute, University of California, Berkeley, Calif.

Sept. 10-12—National Convention, National Aeronautic Assn., Westbury, N. Y.

Sept. 13-14—International Operations and Maintenance Symposium, Airwork Corp., Millville, N. J.

Sept. 13-15—16th Annual Meeting, Armed Forces Chemical Assn., Statler-Hilton Hotel, Washington, D. C.

Sept. 14-15—Ninth Annual Joint Societies

(*Continued on page 6*)

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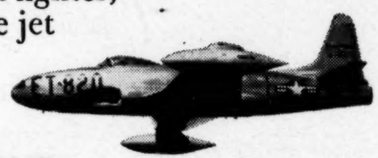

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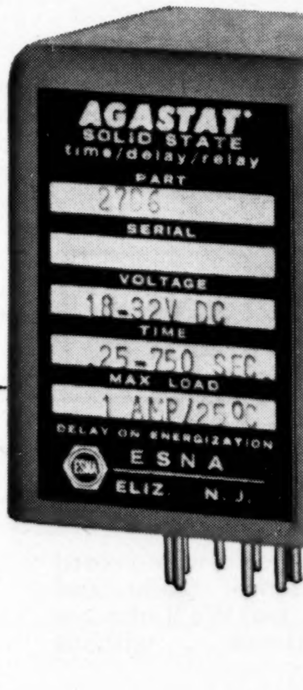

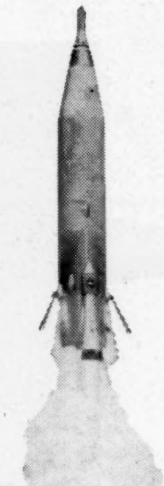

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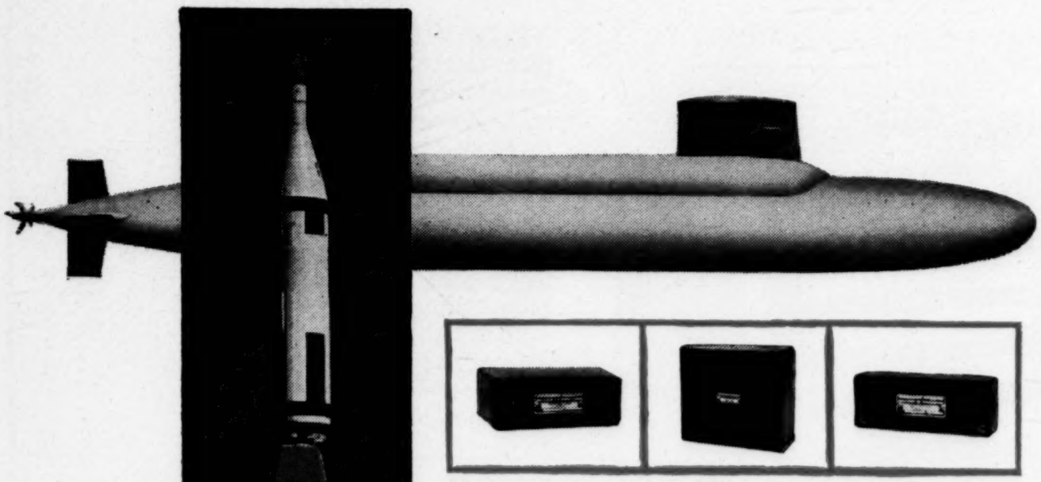

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AVIATION CALENDAR

(*Continued from page 5*)

Engineering and Management Conference, IRE, Hotel Roosevelt, New York.

Sept. 14-15—Conference on Technical-Scientific Communications, Institute of Radio Engineers, Bellevue-Stratford Hotel, Philadelphia, Pa.

Sept. 15-17—Annual Convention, National Assn. of State Aviation Officials, Miami Beach, Fla.

Sept. 18-20—10th Annual Meeting, Standards Engineers Society, Hotel Sherman, Chicago, Ill.

Sept. 20-21—Industrial Electronics Symposium, Institute of Radio Engineers, Bradford Hotel, Boston, Mass.

Sept. 20-24—National Convention and Aerospace Panorama, Air Force Assn., Philadelphia, Pa.

Sept. 26-28—Annual Convention, National Business Aircraft Assn., Mayo Hotel, Tulsa, Okla.

Sept. 29-30—Society of Experimental Test Pilots' Fifth Annual Symposium and Awards Banquet, Beverly-Hilton Hotel, Beverly Hills, Calif.

Oct. 2-4—Seventh National Communications Symposium, Institute of Radio Engineers, Hotel Utica, Utica, N. Y.

Oct. 2-7—12th International Astronautical Congress, Washington, D. C.

Oct. 3-5—National Airports Conference, University of Oklahoma, Norman, Okla.

Oct. 4-6—Semi-Annual Convention, American Society of Photogrammetry, Biltmore Hotel, New York, N. Y.

Oct. 9-11—Mid-Year Conference, Airport Operators Council, Hilton Hotel, El Paso, Tex.

Oct. 9-13—National Aerospace Engineering & Manufacturing Meeting, Society of Automotive Engineers, Ambassador Hotel, Los Angeles, Calif.

Oct. 9-15—American Rocket Society's 16th Annual Meeting & Space Flight Report to the Nation, Coliseum, New York, N. Y.

Oct. 9-15—Aircraft Owners & Pilots Assn. Convention, St. Petersburg, Fla.

Oct. 14-22—Federation Aeronautique Internationale 1961 General Conference, Hotel Quintandinha, Rio de Janeiro, Brazil.

Oct. 19—General Aviation Safety Committee, National Safety Council, Conrad Hilton Hotel, Chicago, Ill.

Oct. 23-24—Joint Meeting, Canadian Aeronautical Institute/Institute of the Aerospace Sciences, Ottawa, Canada.

Oct. 23-25—East Coast Conference on Aerospace and Navigational Electronics, Institute of Radio Engineers, Lord Baltimore Hotel, Baltimore, Md.

Oct. 23-27—17th Annual General Meeting, International Air Transport Assn., Sydney, Australia.

Oct. 24-26—International Symposium on Aero-Space Nuclear Propulsion, Institute of Radio Engineers, Riviera Hotel, Las Vegas, Nev.

Oct. 24-26—Air Transport Assn.'s Engineering and Maintenance Operators Meeting, Americana Hotel, Miami Beach, Fla.

Oct. 26-27—Quarterly Regional Meeting, Assn. of Local Transport Airlines, Sahara Hotel, Las Vegas, Nev.

Oct. 30-Nov. 1—Annual Meeting, Air Traffic Control Assn., Deauville Hotel, Miami Beach, Fla.

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Space Patent Rules Facing Challenge............ 26
▶Industry witnesses reluctant to complain about NASA policies; Congress to survey 50 companies.

Southern Strike Stirs Pilot Discontent........... 38
▶ALPA members move to force decision by challenging their president; weigh censure and term reduction.

Litton Is Developing Space Data System.......... 88
▶Prototype flight data system is capable of obtaining and providing data for control of earth orbital aerospace vehicles.

SPACE TECHNOLOGY

Space Patent Rules Face Challenge... 26
Explorer XII Sends Mass of Data..... 28
Ranger I Misses Planned Path....... 29
Teams Surveying Apollo, Booster Sites 30
NASA to Buy Nova Launch Site...... 30
Radio Frequency Demands......... 31
Delta Puts Five Satellites Into Orbit.. 33
B-52 Use as First-Stage Booster...... 72
Aerobee Junior Fired Underwater.... 80

MISSILE ENGINEERING

Ling Recommended to Build ARM.... 37
Camera Records Minuteman Separation 79

AERONAUTICAL ENGINEERING

HP 115 Makes First Flight.......... 34
Crane Combines Fixed, Rotary Wing.. 59
Production Briefing 65
New Aerospace Products........... 69

AVIONICS

Litton Developing Space Data System. 88
Models Aid Earth Current Data...... 94
Raytheon Designs Machine That Learns 98
New Avionic Products............. 93
Filter Center 100

SAFETY

Blade Fatigue Cited in S-58 Crash.... 102

AIR TRANSPORT

Southern Strike Discontent......... 38
Berlin Stymies U. S.-Soviet Route Pact 39
Airlift Hauls Insecticide to Egypt.... 40
Second FEIA Walkout Feared........ 41
Frontier Seeks Subsidy-Free Operation 42
Workers Strike Bankrupt British Line. 43
Boyd Impresses Airlines as CAB Chief 45
BEA Records New Profit........... 47
British Air Freight Rate Reductions.. 48
Airline Officers List Salaries With CAB 48
Shortlines 52
Airline Observer 52

MANAGEMENT

British Plan Increased Helicopter Use. 54
Who's Where 23
Industry Observer................ 23
Washington Roundup 25
News Digest 37

BUSINESS FLYING

British Unveil Light Plane Entries.... 32

FINANCIAL

Texas Instruments' Profit Decreases. 81
NASA Contracts................. 77
USAF Contracts 80
Financial Briefs 81
New Offerings 84

Calendar 5
Letters 118

EDITORIAL

Disarmament Agency Drive......... 21

COVER: Strategic Air Command GAM-77A is launched from a B-52G during final tests of the missile over the Eglin Gulf Test Range recently. Supersonic Hound Dog, currently nearing operational status with SAC, is powered by 7,500-lb.-thrust Pratt & Whitney J-52 engine and operates at supersonic speed ranges. G Model of the B-52 carries one under each wing in addition to internal weapon stores.

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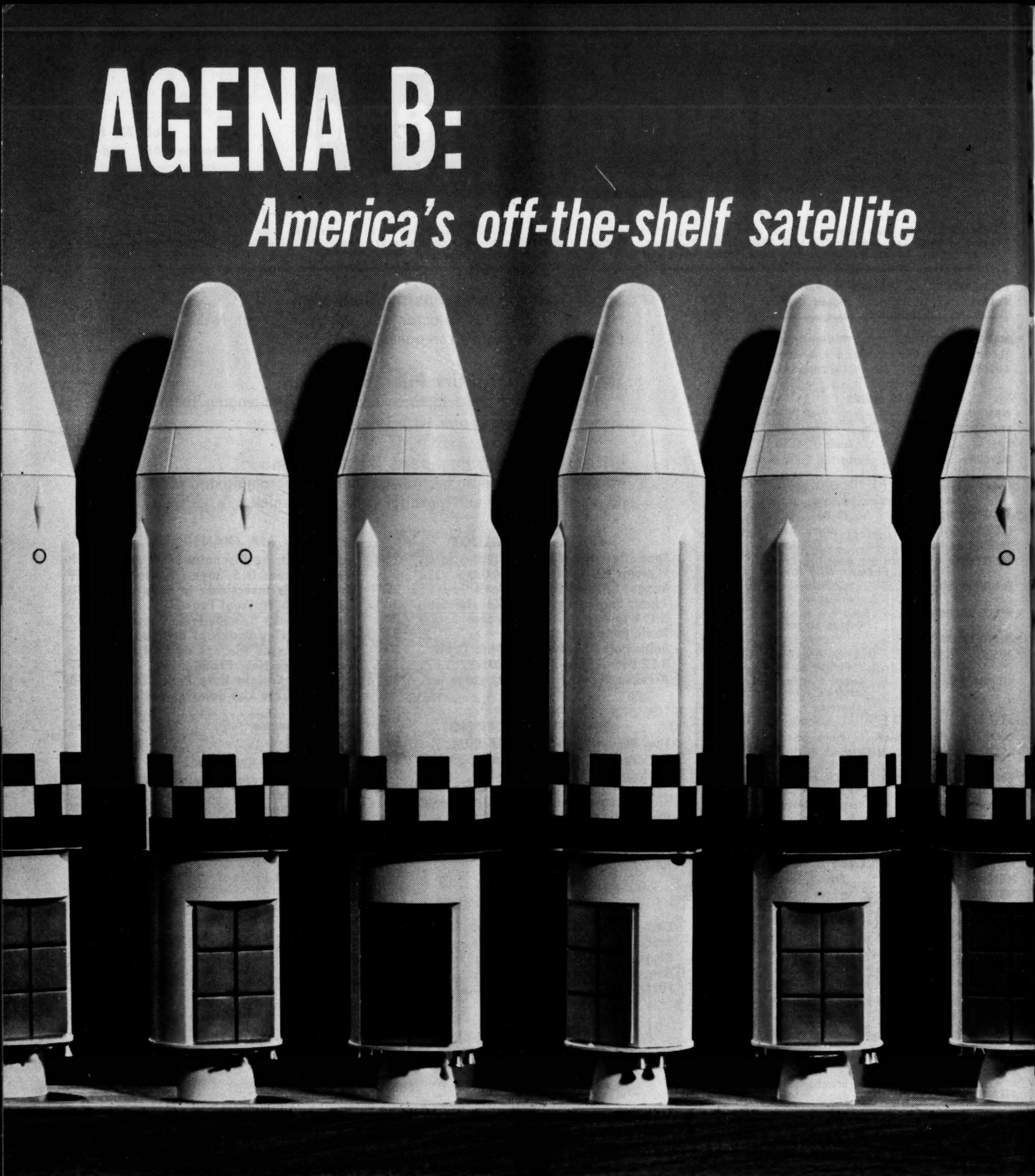

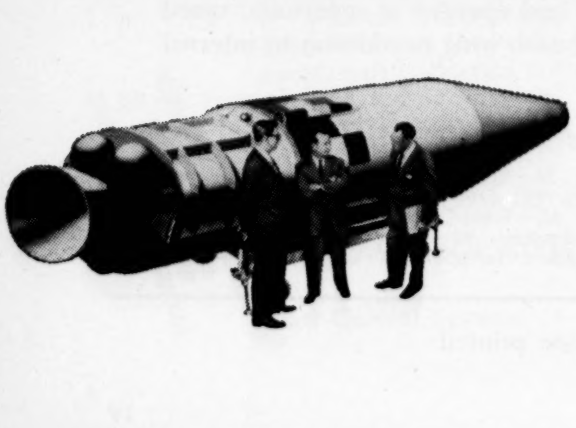

Down the production line at Satellite Center, U.S.A.* move the Agena B satellites now being used in many of the nation's major space programs. The Agena B proved its reliability in the trail-blazing Discoverer program. It is easily adaptable to a wide range of payloads and missions. And its powerful start-and-stop rocket engine can maneuver it precisely to any orbit. The Agena B is built by Lockheed. Major subcontractors: General Electric, Bell Aerospace, and Philco.

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EDITORIAL

Disarmament Agency Drive

Overshadowed by the big black newspaper headlines on the Berlin crisis, a determined effort is under way on Capitol Hill to create a new agency of the government devoted solely to the problems of disarmament. This agency would be known as the U. S. Disarmament Agency for World Peace and Security, be operated on a $6-million annual budget and be staffed with about 250 people (AW Aug. 21, p. 19). The bill that would authorize its establishment states that this agency "must have the capacity to provide the essential scientific, economic, political, military, psychological and technological information upon which realistic disarmament policy must be based."

The disarmament agency would supply position papers to U. S. negotiators and have a full-time technical staff competent to find the holes in Russian proposals. In short, the agency would do the homework for our negotiators and work full time at finding technological and diplomatic ways to break the disarmament deadlock. U. S. disarmament negotiators readily admitted during hearings on the proposed legislation that they often were not well-enough prepared to take on the Russians at the conference table.

The effort to create this new agency reflects a general realization that all of the florid oratory devoted to disarmament in recent years has been sadly ineffective because it lacked a solid, factual base concerning the technical facets of the problem outlined above. Before any real progress can be made toward a genuine and effective disarmament agreement, a solid foundation of facts must be laid to replace the nebulous oratory that has sufficed in the past.

Need for Research

There has been strong, bi-partisan political support for the new agency despite its mouth-filling title and stupendous tasks. One aspect that has emerged from the congressional hearings on the subject is the lack of adequate research and development in the area of new and more efficient methods of detecting nuclear explosions. The lack of positive proof of the character of the recent large underground explosions in the Soviet Union offers ample illustration of the need for better detection systems. The Soviets have claimed that these explosions were non-nuclear, earth-moving operations, while some U. S. legislators have claimed that they were underground tests of small nuclear weapons (AW Aug. 14, p. 26).

Although it is obviously more prudent to assume the worst possible connotation of these Soviet underground blasts, it is also obvious that we need devices that will positively identify their character. Dr. Herbert York, a nuclear expert who also was director of research and engineering for the Defense Department in the Eisenhower Administration, has said that the surface has barely been scratched in this field, and we hardly know yet what the problems it poses really are. He also noted that development of effective nuclear blast detection devices is far more difficult than the development of nuclear weapons. We hope that regardless of the fate of the disarmament agency bill in the current Congress, action will be taken to expand both the scope and pace of nuclear detection research, because this area is the technical foundation on which any sound disarmament proposals must be based.

Congressmen report they are receiving a heavy flood of mail from their constituents opposing the disarmament agency because "now is not the time" and because of fear that it will weaken our international posture of determination in the face of the Berlin crisis. John J. McCloy, President Kennedy's disarmament adviser, points out that we probably will have to wait a very long time indeed if we wait for a period of international calm in which to launch the disarmament agency. We have been delinquent in not taking the factual approach to the problems of disarmament years ago. To delay any longer, regardless of the international scene, will simply postpone the possibilities of moving toward effective action.

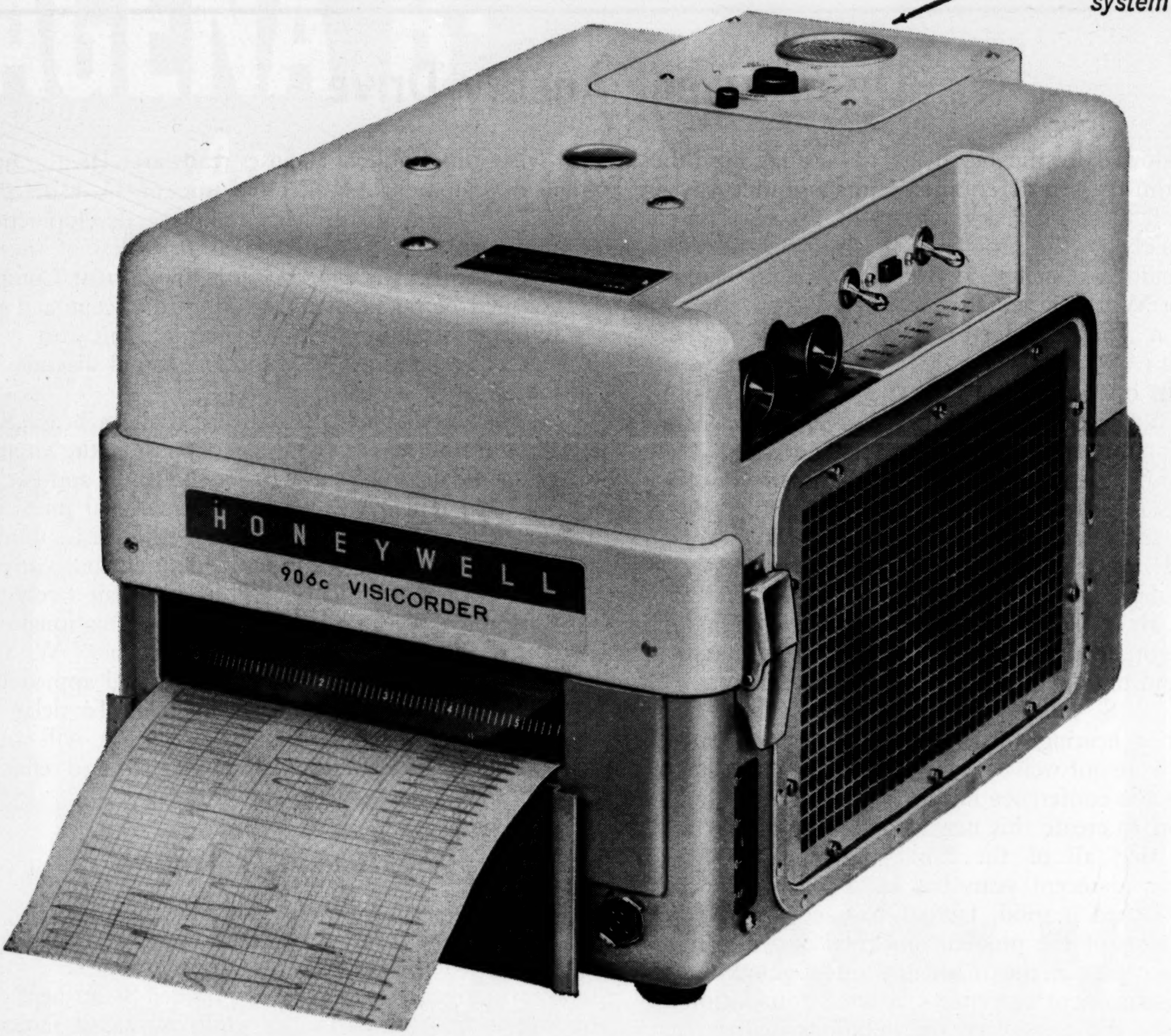
Soviet-Built Image

It may be difficult for U.S. citizens who have not traveled abroad extensively in recent years to realize how the Soviets have cleverly constructed a false image of a warmongering, saber-rattling United States bent only on imposing its will on the world by naked force. It comes as a shock for U.S. citizens abroad to encounter the effects of this blatant campaign, but we have done precious little about combatting it effectively. The establishment of the disarmament agency, with a corresponding technical effort to develop better surveillance and detection devices, would be a big help in dispelling this false image of us created by the Soviets.

Even while the disarmament agency bill is moving through the legislative process, the Commerce and Treasury departments are making new studies of the impact of disarmament on U.S. industry. These studies will supplement the similar study conducted recently by Sen. Hubert Humphrey (D.-Minn.), and are another part of the Kennedy Administration's effort to convince the rest of the world that we are genuinely serious about developing a real solution to the problem of a nuclear arms race.

Nobody can predict now whether there ever will be an effective solution for the disarmament question. But if we fail to begin now to explore every possible means of achieving this solution and every possible technical support for it, we shall have failed miserably, not only in our duty to ourselves but also to the rest of the world that still looks to us for leadership and guidance.

—Robert Hotz



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WHO'S WHERE

In the Front Office

Webster H. Wilson, board chairman of Hazeltine Corp., Little Neck, N. Y., succeeding **W. A. MacDonald**, deceased. Mr. Wilson continues as president.

Allen F. Donovan, elected to the Board of Trustees of Aerospace Corp., Los Angeles, Calif. Mr. Donovan is the company's senior vice president-technical.

The Rt. Hon. Lord Brabazon of Tara, appointed chairman of the Air Safety Board, Ministry of Aviation, London, England, succeeding **Air Marshal Sir Charles Guest**, retiring.

Robert H. Wendt, executive vice president and general manager of American Latex Products Corp., Hawthorne, Calif., a subsidiary of Dayco Corp., and president of Hardman Tool and Engineering Co., Los Angeles, Calif., succeeding **C. M. Christie** who has resigned as president of both companies.

Edward H. Perkins, Jr., president, Brooks & Perkins, Inc., Detroit, Mich.

Capt. Henry A. Arnold (USN, ret.), assistant to the vice president and chief scientist, United Aircraft Corp., East Hartford, Conn.

James T. Duffy, Jr., president, Brantly Helicopter Corp., Elkhart, Ind., succeeding **N. O. Brantly** who continues as board chairman.

Cecil P. Milne, a director and chairman of the executive committee, Chicago Aerial Industries, Inc., Barrington, Ill. Named CAI vice presidents: **H. W. Heffernan**, manufacturing; **G. H. Hoeck**, administration; **W. B. Johnson**, engineering; **J. H. Thompson**, sales; **R. A. Willard**, finance.

Alaska Airlines, Inc. has named the following vice presidents: **Chester L. Miller**, operations; **George R. Sindt**, maintenance and engineering; **Raymond J. Wadsworth**, sales.

Edward Reynolds, Jr., treasurer, The Mitre Corp., Bedford, Mass.

Bromley K. Smith, executive secretary of the National Security Council.

Col. Alonzo A. Towner, staff surgeon, Strategic Air Command, Offutt AFB, Neb., succeeding **Brig. Gen. John R. McGraw**, retiring.

Changes

George A. Harter, study director, Electronics Division of Space Technology Laboratories, Inc., Los Angeles, Calif., a subsidiary of Thompson Ramo Wooldridge, Inc. Other Electronics Division appointments: **J. J. Seidman**, manager, and **C. R. Russell**, associate manager, Computer Department.

Dr. Isidore Hodes, head of Plasma Physics Laboratory, Aero/Space Department, General Motors Defense Systems Division, Santa Barbara, Calif., and **Arthur A. Vuylsteke**, assistant.

General Electric Co.'s Flight Propulsion Division has appointed **A. J. Burrows** to its Washington, D. C., office to be responsible for Air Force and Navy production engine programs, including foreign Military Assistance Programs.

(Continued on page 101)

INDUSTRY OBSERVER

▶ Low-angle drogued delivery (LADD) technique now is replacing the earlier LABS delivery of nuclear weapons from low flying aircraft. Improved accuracy of the drop and increased survivability of aircraft and crew were major reasons for the change. Pilot makes the same low-level run-in to the target, pulls up only slightly at bomb release to peak altitude of several hundred feet, then half-rolls, pulls positive g to decrease altitude, half-rolls again on the descent and pulls out with positive g to continue at low level.

▶ Extremely high-intensity beams from optical masers may cause serious damage or even blindness in the human eye if the beam falls directly on eye tissue. USAF's Rome Air Development Center is sponsoring a study by New York University of biological effects of these beams, using animals as subjects.

▶ Captive flight tests of the USAF-Douglas Skybolt air-launched ballistic missile were begun late last month at Edwards AFB, Calif., shortly after tests of electromagnetic interference between the missile and the Boeing B-52 launching aircraft were completed. Air launch tests are continuing at Eglin AFB, Fla.

▶ Watch for Army to create its own test pilot school to train pilots in evaluation of helicopters, assault transports and tactical fighters. Recent graduates of the all-Army course at the USAF experimental test pilot school considered the course too specialized in high-performance aircraft. School had no helicopters or low-speed aircraft for student flying.

▶ Plan to launch a Mercury communications package into orbit with a Blue Scout vehicle has been scrapped. Package systems failed to check out and the project slipped until the first attempt to orbit a complete Mercury capsule aboard Mercury-Atlas 4 overtook it.

▶ Many aerospace firms are expected to bid in National Science Foundation's competition next month for the Project Mohole contract. Program, also supported by Navy and National Academy of Sciences, may reveal valuable oceanographic and geological data by sampling earth's crust at the ocean's bottom. Main drilling effort will take place in the Atlantic off Puerto Rico. Contract will cover drilling, exploration and mapping, as well as data gathering, reduction and analysis. National Science Foundation, apparently tired of dealing with a number of small companies as it did earlier, wants a prime or team contractor.

▶ First USAF-Lockheed C-141 jet cargo transport is expected off the assembly line in August of 1964, with five more due that September. Operational deployment date is June, 1965. A contract for 32 aircraft is expected to be let by December of this year.

▶ First flight of a Bios space probe, which is a follow-on to the Nerv program, will be made by National Aeronautics and Space Administration this fall from Pt. Arguello, Calif. An Argo D-8 will be used to send the package, containing sea urchin eggs, skin tissue and bread mold, through the Van Allen radiation belts.

▶ Investigation by USAF's Aeronautical Systems Division has indicated that use of the super high frequency range from 3 kmc. to 30 kmc. may solve the problem of transmitting radio signals through the ionized layer of air that surrounds missiles and spacecraft re-entering the atmosphere from ballistic and orbital flights.

▶ First sale of a Canadian Black Brant research rocket has been made to Air Force Systems Command's Air Proving Ground Center at Eglin AFB, Fla. Rocket is being developed by Canadian Armament Research & Development Establishment and Bristol Aero-Industries, Inc. (AW July 17, p. 67).

▶ Rocket sled test track at Hurricane Mesa, Utah, which is operated for Air Force by Coleman Engineering Co., will be put on a standby basis in December. It has been used primarily for tests of ejection seat systems.

SILICOLOGY *Studies in Silicones*

HOW THESE TIME-TESTED MATERIALS CAN WORK FOR YOU

Silicone Rubber Takes to the Air ...And a Customer Tells Us Why

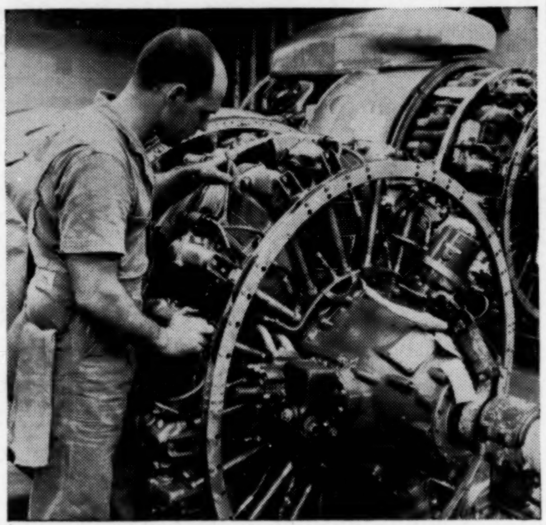
A recent letter from a UNION CARBIDE Silicone Rubber customer is one of those that makes us like to read our mail. We quote parts of it below in the hope that it will serve as a "refresher" on the properties that have made silicone rubber virtually indispensable in modern aircraft.

The letter is from the Engineering Laboratories of the Electric Autolite Company, Wire and Cable Division, Port Huron, Mich., which states:

RESISTS OZONE, CORONA, COLD, AND MOISTURE

"Silicone rubber, because of its excellent heat resistance and dielectric strength, has been specified as insulation on aircraft lead wire for a number of years. More recently, these same properties have promoted its use on ignition cables for automobiles, aircraft, and military vehicles. Spark plug boots, attached to the cables, are also molded of silicone rubber because of the continuous high temperatures to which they are subjected.

"In addition to dielectric and heat-resisting properties, there are other advantages in the use of silicone extruded insulation. It is readily compounded for extrusion, extrudes smoothly, and strips easily from the conductor; the finished wire has excellent shelf life as well as good service life, it can be used at high altitude, remains flexible at low temperatures, and resists ozone, corona, and moisture."



SILICONE rubber-insulated wire and cable, capable of withstanding continuous high temperatures, is used in powerful aircraft engines.

MORE RELIABLE FOR CARS, TOO

The letter gives a forward-looking hint to Detroit as it goes on to state: "Newer automobile engine designs, for greater efficiency by operation at higher temperatures, should further increase the requirements for this more reliable ignition cable.

"UNION CARBIDE Silicone Rubbers are among those used for The Electric Autolite Company's insulated wires and cables, and their KW-1330 silicone rubber base has been approved for use on ignition cables."

U. S. NAVY'S WV-2 far-flying sentinel, which can stay airborne for extended periods of time, carries America's most powerful search radar as part of the nation's defense against sneak attacks.

Bendix Corporation, Scintilla Division, is one of Autolite's customers. Bendix in turn supplied the silicone-insulated spark plug leads for engines that power such giants of the skies as the Lockheed Super Constellation-type radar airplanes, designated by the United States Navy as WV-2. Able to range far out to sea and carry out special early warning missions, this long-distance plane carries America's most powerful search radar to high altitudes to avoid normal limitations from radar's inability to bend over the horizon.

WHERE CAN SILICONES BENEFIT YOU?

You'll also find silicone-insulated ignition cables boosting the reliability of military vehicles, tanks, and trucks. And if you're a track fan, they're virtually a "must" to stock car racers.

Aircraft technology and development are changing more rapidly than ever before. Perhaps you are overlooking a good bet—some place in the design of your products where a UNION CARBIDE Silicone Rubber can serve you, improving quality at a surprisingly low cost. Send the coupon for further information.

UNION CARBIDE

SILICONES

UNION CARBIDE is a registered trade mark of Union Carbide Corporation.

Silicones Division
Union Carbide Corporation
Dept. HA-9105, 30-20 Thomson Avenue,
Long Island City 1, N. Y.
***In Canada:* Union Carbide Canada, Ltd.,**
Bakelite Division, Toronto 12.

Please send me data on ______________________

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NAME ______________________________

TITLE ______________________________

COMPANY ______________________________

ADDRESS ______________________________

CITY ______________ ZONE ____ STATE ______

Washington Roundup

Far East Buildup

Urgent buildup of conventional war materiel and personnel in the Far East, particularly in Southeast Asia, is being directed by the Joint Chiefs of Staff, indicating that the Administration fears the crisis in Berlin may be chiefly a diversionary action. Biggest effort is in The Philippines, with a lesser buildup in Formosa and Okinawa.

Monsoon rains in the Viet Nam, Laos, Cambodia, Thailand and Burma areas ease in October and are gone by the end of November. This permits jungle operations to be resumed, principally by allowing surface and air supply lines to operate unhampered by weather.

Effect of the buildup already is being felt in industry in an acceleration of production of items already on order. Full effect will be felt next month in companies producing small arms, battlefield rockets, light vehicles, helicopters and close-support armament. Marines and Army are increasing troop strength in the area, and Navy carrier strength will be augmented.

Air Corridor Trouble

Russia took another step last week toward a possible closing of the air corridors from West Germany into West Berlin by protesting to the Western powers that the corridors are being used to transfer "all kinds of revanchists, extremists, saboteurs and spies" from the Federal Republic of Germany to the tense, divided city.

Last Aug. 1, Russia transferred control over air traffic using the corridors to the East Germans. Although there had been no incidents through late last week, the turnover of control has been considered a first step toward any crisis Russia might want to provoke over use of these airways.

As a part of its pressure campaign on Berlin, Soviet Russia has printed an eyewitness account in Komsomolskaya Pravda of a visit to a missile plant where "a flowline has produced 250 rockets with hydrogen charges" in one year. The plant comprises "a whole town with its own transport, communications and even its own power station." Location of the plant and significant details of its operation were not included in the article, but the usual Communist commercial was. Such plants, it said, "are closed [to the public] and they shall stay closed until the threat of war shall be completely eliminated, until Soviet suggestions on universal and complete disarmament are accepted."

Navy Space Shift

An end to internal bickering and personality conflicts in Navy's space efforts is expected when Rear Adm. Jack P. Monroe, who has commanded the Pacific Missile Range for three years, arrives in Washington late next month. Although details have not yet been worked out, the Astronautics Operations Division under Deputy Chief of Naval Operations for Air, Vice Adm. R. B. Pirie, and the Astronautics Development Division under Deputy CNO for Development, Vice Adm. J. T. Hayward, will be combined. Adm. Monroe will head the new organization and will report to Adm. Hayward. Rear Adm. John E. Clark, commander of Carrier Division 16, will replace Adm. Monroe at PMR.

India's answer to U. S. military aid to Pakistan—which is to include providing the Pakistani air force with Sidewinder infrared air-to-air missiles—is a revelation that Indian scientists have successfully experimented with Indian-made air-to-air missiles. Prime Minister Jawaharlal Nehru told the Indian parliament that work has been going on for several years and that the missiles are in limited production.

Testimony before the Senate Commerce Communications Subcommittee revealed that Justice Department has approved the "no-rights" patent provisions of the precedent-setting National Aeronautics and Space Administration-American Telephone & Telegraph Co. satellite contract but has never read the text of the full contract.

Cosmonauts' Views

Russia's first cosmonaut made news last week with a remark that U. S. spacemen would like to have elaborated. Maj. Yuri A. Gagarin, who made the first manned orbital flight of earth last April, told a press conference in Budapest that the Vostok spacecraft are not suitable for travel to the moon, but said Soviet scientists are working on a moon project that "could take anything up to five years." Gagarin added that "the Americans, however, may get there before us." Newsmen reported that he smiled when he said it.

Maj. Gherman S. Titov, Russia's second cosmonaut, wrote in Pravda that as he tried to sleep in orbit, "I awoke because of some kind of strange position of my body. I saw my arms had risen by themselves and were hanging in the air." He tucked his hands under his safety belt and went back to sleep. The sensation, he said, is "as though one were on an ocean wave."

Navy has decided that designs for the tri-service VTOL transport, on which Air Force and Army have agreed, aren't compatible with shipboard operations. It probably will not participate in the program but would still furnish its share of funds.

Most interesting sentence in a Civil Aeronautics Board order last week consisted of 284 words, the first of which was: "Briefly. . ."

—Washington Staff

Space Patent Rules Facing Challenge

Industry witnesses reluctant to complain about NASA policies; Congress plans to survey 50 companies.

By George C. Wilson

Washington—Acceleration of the multi-billion-dollar U. S. space program finds the aerospace industry increasingly worried about the National Aeronautics and Space Administration's patent policies—but also increasingly worried about saying so.

This peculiar trend shows itself in the industry's latest attitude toward public hearings on patent policies and in statistics on inventions disclosed to NASA.

An Aviation Week study indicated that only a fraction of the inventions made under NASA research contracts actually are reported to the space agency. The contractors apparently feel that, under NASA patent policies, competitors will exploit the inventions once they have been reported.

Aerospace firms, despite their anxiety over the NASA regulations, were reluctant to express their fears before the House Science and Astronautics Patents Subcommittee. Their reluctance, according to those directly involved, is based largely on the belief that such testimony might hurt their chances of getting future NASA contracts. The subcommittee now will try to get more indication of industry's views on NASA patent policies by sending questionnaires to about 50 aerospace companies.

As of the Aug. 23 deadline, few firms had asked formally to be heard at a public hearing on the proposed patent regulations which NASA has scheduled for Sept. 20. This does not indicate lack of interest, since the regulations would give the space agency a radically new role in the invention field. Instead, observers here believe the industry's lack of response stems more from reluctance to offend NASA, plus a feeling that Congress will change the patent rules anyway.

NASA Patent Statistics

The 1958 space act gives NASA title to inventions made by contractors working under agency research and development contracts. However, the act does empower NASA to waive its title to an invention after the contract is signed. But industry spokesmen have complained that the waiver procedure is more trouble to contractors than it is worth. One apparent result of this feeling is for industry to conceal the inventions.

Figures, compiled by NASA between enactment of the 1958 space act and Aug. 23 of this year, show that:

- **Only 201 inventions** have been disclosed by NASA contractors. Of this total, 87 were disclosed by United Aircraft, 42 by other commercial contractors and 72 by such non-profit firms as the California Institute of Technology's Jet Propulsion Laboratory. JPL alone accounted for 65 of the 72 inventions disclosed by non-profit firms.
- **In contrast, 331 inventions** were disclosed by NASA employes. Since NASA employes do only about 15% of the total space research, this clearly indicates that the private firms who do the remaining 85% are not disclosing all their inventions.

Subcommittee Hearings

Chairman Emilio Q. Daddario (D.-Conn.) of the House Science and Astronautics Patents Subcommittee this month recessed a long series of hearings of NASA patent policies. It is an open secret that the subcommittee ran into resistance when it invited firms to testify. But those who did appear added to the criticism of the general NASA patent policy and expressed alarm over the proposed patent regulations published in the Federal Register last July 15.

USAF Acts on New Policy

Washington—Air Force has taken steps to implement a new policy for managing the development and production of command and control systems under which its Electronic Systems Division and the Mitre Corp. will assume system engineering responsibilities formerly delegated to prime contractors.

Norad combat operations center (425-L) will be the first new system to be developed under the new policy, which was first disclosed by Dr. Brockway McMillan, assistant USAF secretary for research and development, at the recent Military Electronics Convention (AW July 3, p. 28).

Burroughs Corp. recently was selected as prime contractor for detailed design, acquisition, installation and test of the 425-L system. Mitre Corp. will provide USAF with general systems engineering assistance and Systems Development Corp.—another not-for-profit company—will undertake responsibility for computer programing.

William H. Armistead, vice president and director of research and development for Corning Glass Works, told the subcommittee that the patent provisions in the NASA act "are so broad in their language and sweeping in their possible effect on our business that Corning has not dared to enter into any agreement with NASA or any of its prime or subcontractors which might be construed to involve research and development work on our part.

"The risk of losing to the government all rights in inventions and technical data arising out of the performance of such a contract are too great for the company to assume."

Declaring that Corning spent $9.3 million in 1960 on research and development, Armistead contended that "the contractor should at least be permitted to retain and use those inventions and technical data which his skills have created."

In a similar vein, Ernest A. Goetz, technical assistant to the president of American Bosch Arma Corp., told the subcommittee the NASA patent policy has "a debilitating effect upon industrial incentive and undermining effect on our traditional U. S. patent system." Many of the aerospace witnesses said under questioning that the patent system threatened to slow down the U. S. space effort.

Defense Policy Favored

The aerospace industry favors the Defense Department's policy over NASA's. Defense, without employing NASA's complicated waiver procedures, usually gives the contractor title to the inventions he makes under the research contract. However, Defense retains the right to have the invention manufactured for its own use without paying royalties on it.

But in the commercial field, the inventing contractor under the Defense arrangement has the exclusive right to exploit the invention. Backers of the Defense policy maintain it provides the needed incentive for making and marketing inventions.

The proposed NASA patent regulations do not affect the agency's procedures for waiving title to inventions made under research contracts. The rules pertain only to licensing of the inventions owned by NASA. Under the proposed rules, the inventing contractor automatically would be licensed to market his invention after he had reported it. He would hold this license for eight years or for five years after the date the patent was issued, whichever came first. If he did not exploit the invention within that period, NASA after a public hearing could license another contractor to manufacture it.

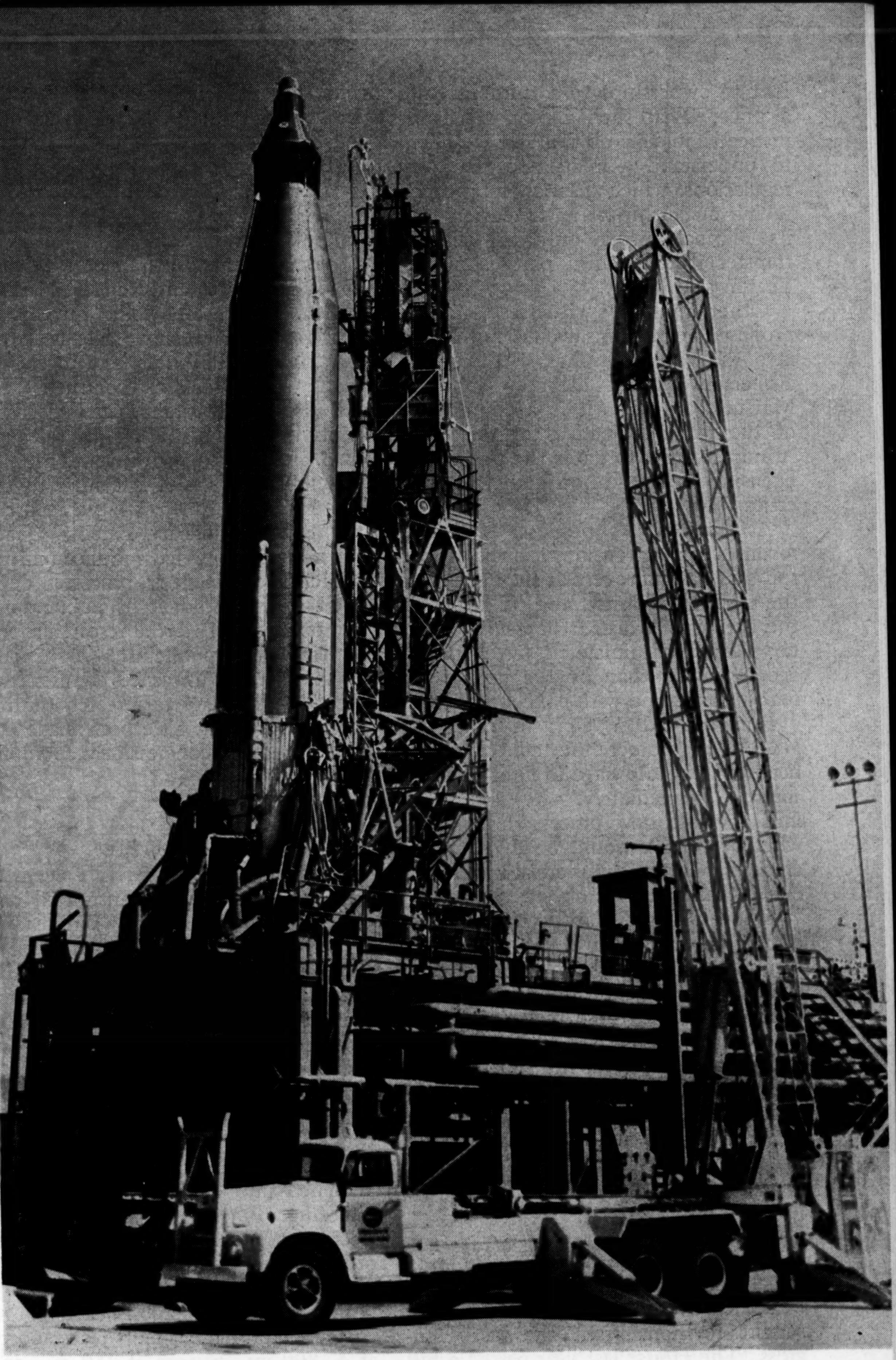
The inventing contractor under the rules would obtain a nonexclusive, royalty-free license. This would enable him to market the invention without paying royalties to NASA. But his license would not stop other contractors from competing with him by getting licenses of their own from NASA.

NASA lawyers contend, however, that the inventing contractor enjoys two big advantages under this arrangement. First, he automatically gets a license as soon as the invention is disclosed to NASA. Therefore, he can start exploiting the invention right away while other contractors must wait for the patent to be issued—this usually takes two or three years. Besides this headstart, the inventing contractor would not have to pay NASA the royalties charged his competitors.

NASA's rationale for issuing licenses to some other firm if the inventor does not exploit his invention is to ensure that it gets into public use. This second contractor would have sole right to the invention, since NASA would issue him an exclusive license. This, according to NASA lawyers, would provide the incentive needed to get the invention produced.

The proposed regulations do not explain how far NASA would go in protecting its licensees from infringement. This point will be discussed at the public hearings Sept. 20. As of the Aug. 23 deadline for getting on the hearing's witness list, NASA said it had received requests from only five parties: Allis-Chalmers Manufacturing Co., Electronic Industries Assn., National Assn. of Manufacturers, National Security Industrial Assn. and Princeton University.

Gerald D. O'Brien, NASA assistant general counsel for patent matters, told Aviation Week he was "disappointed" that the response was not greater. O'Brien said contractors in the aerospace industry do not appreciate that NASA's proposed rules "put the inventing contractor in a preferred position" when it comes to promoting the invention. None of those who have asked to appear intend to support NASA's proposed licensing regulations, O'Brien said. He said the response indicates industry "has not really grasped" the potential benefits of NASA's proposed rules. Despite the witness list deadline, NASA will not deny others from being heard at the public hearing.



MA-4 Prepared for Launch

Mercury-Atlas 4, scheduled for launch late last week from Cape Canaveral, Fla., is designed to provide a rigorous test of the complete Mercury system in a one-orbit flight. The McDonnell capsule was used before, aboard MA-3 Apr. 25. The Atlas blew up 61 sec. after launch, but the escape tower pulled the capsule free and it was subsequently recovered. Note new, heavier adapter section between the capsule and the General Dynamics Atlas.

Samuel C. Yeaton, vice president and director of patents for the Sperry Gyroscope Division of Sperry Rand Corp. previewed industry opposition to NASA's proposed rules when he appeared before the House patents subcommittee.

Yeaton called them an "anomaly," and said: "First NASA takes ownership of the invention away from the contractor, thereby destroying (despite the fact he retains a royalty-free non-exclusive license) any incentive which would induce him to run the normal risks of exploitation. Then NASA fails to find anyone else who will be willing to pay a royalty for the 'privilege' of similarly running the normal risks of commercial exploitation pursuant to a non-exclusive license.

"Then, after thus depriving the public of the use of the invention all these years, NASA proposes to transfer the ownership (exclusive license is equivalent to ownership) to a third party for a price. That such a proposal flaunts justice should be obvious. It is difficult to understand a mixture of laws and regulations which has as its purpose taking ownership of an invention from its original owner only to belatedly transfer it to a third party stranger," Yeaton said.

Other industry witnesses said the proposed regulations would put NASA into the patent business. William D. Roberson, patent attorney for The Martin Co., said "it is a compromise of the prime objectives of the Space Administration to enter the business of licensing its physical or intangible properties."

As for NASA's proposal to collect royalties from inventions it owns, Roberson said "any recovery as such goes into the federal treasury and is really in the nature of a tax. It happens to be a tax that is administered by a specific agency rather than by the people primarily concerned with collecting taxes."

Roberson added that in order for NASA to protect the contractors it licensed, it would have to fight infringement. "Immediately," he said, "you find a whole new process developing" whereby NASA would be diverting its energies into commercial channels rather than scientific ones.

Albert C. Hall, Martin vice president of engineering, told the patents subcommittee that it is "important to change the patent situation now as NASA gets into these bigger programs in order to get greater effect from the individual small company contributor."

Several other witnesses told the subcommittee the smaller contractors, rather than the industry giants, stand to lose the most from not being able to exploit inventions.

NASA's Position

NASA's defense against upcoming attacks on its patent law is somewhat weakened by the fact that NASA itself sought revisions from the last Congress. The House last year passed a bill endorsed by NASA that would have given NASA patent authority similar to that of the Defense Department. But the measure was not approved by the Senate, where several committees were investigating government patent practices with the hope of coming up with one over-all policy.

Earlier this year, NASA told Congress it did not intend to press for changes in the space act regarding patents. James E. Webb, NASA administrator, told Aviation Week the space agency did not wish to hinder other urgent NASA legislation before Congress and also had found the patent rules did not pose the problem originally expected. NASA's attitude took the steam out of the drive to pass patent legislation in this session of Congress, postponing the decision until next year.

Patent legislation pending in Congress ranges from a bill sponsored by Sen. Russell B. Long (D.-La.) to identical measures introduced by Chairman Overton Brooks (D.-La.) of the House space committee and Rep. Daddario.

Sen. Long's bill would give NASA and any other executive agency "exclusive right and title to any invention" made under research contracts. The bill also would establish a Federal Inventions Administration to safeguard U. S. interests in such inventions.

Sen. Long's stand is similar to that expressed last Apr. 3 in the report of the Senate Judiciary Patents, Trademarks and Copyrights Subcommittee: "Patents obtained or processes developed as a byproduct of public funds appropriated for general research should be reserved for public use. They should not be given as unearned bonuses from the U. S. Treasury to research contractors whose efforts have been made possible by general congressional appropriations without any legislative provision for a patent policy."

The Brooks-Daddario bill would empower NASA either to keep or relinquish title to inventions but would in any case retain a royalty-free license for the U. S. This would, in effect, give NASA statutory authority similar to that embodied in Defense Department regulations. Rep. Daddario told Aviation Week the key to the patent problem was "flexibility." He said his bill would give the NASA administrator the flexibility needed to induce contractors to participate in the space program and to protect the public interest.

The Commerce Department and National Aeronautics and Space Council in consultation with other executive agencies are trying to work out an over-all patent policy in time for consideration during the next session of Congress.

These studies plus NASA's Sept. 20 hearing on its proposed licensing rules are expected to have a profound effect on modification of patent laws to meet space age requirements.

Explorer XII Sends Mass of Data

Washington—Explorer XII energetic particles satellite has transmitted data continuously since launch but readout stations will be put on a periodic data acquisition schedule Sept. 1 because the satellite is producing more information than is needed, National Aeronautics and Space Administration said last week.

Scientists are receiving a mass of data on radiation and on the outer fringes of the earth's magnetic field from the 83-lb. satellite, which was launched into a highly elliptical orbit last Aug. 16 (AW Aug. 21, p. 33). Because of its 26 hr. 25 min. period, orbit was not confirmed until Aug. 17. The orbit carries the satellite through both Van Allen radiation belts.

Refined orbital elements place apogee at 47,800 mi., perigee at 180 mi., and inclination at 33.3 deg. Apogee and period are less than planned, but NASA says they are well within nominal requirements. Variation of plus or minus 8,000 mi. from the 54,000 mi. desired can be expected from the third-stage velocity increment, NASA said.

The satellite was launched by a NASA-Douglas Delta vehicle (see p. 33), marking the fifth consecutive successful satellite launch for Delta.

NASA is using a mobile receiving unit at the Agricultural Research Center, Beltsville, Md., to obtain real time data, but the agency said it has not had an opportunity to arrive at any scientific conclusions. Detailed analyses will be made when magnetic tapes are received from the primary readout stations in Johannesburg, South Africa; Woomera, Australia; Santiago, Chile.

Satellite has a one-year electronic life expectancy because radiation effects are expected to degrade the output of electronics components by that time. Lifetime of the satellite in orbit will be determined by the extent of the moon's perturbation.

Dr. Frank B. McDonald, project scientist from NASA's Goddard Space Flight Center, said the satellite is expected to observe auroral as well as Van Allen radiation, solar wind and the outer portions of the magnetic fields. Solar winds are believed to be the chief means of propagating sun-earth effects such as magnetic storms, he said.

Data are stored in a 512-core memory unit, which sorts the information and feeds it to the frequency modulated telemetry. Data are being transmitted over 136.02 mc.

U. S. Plans Workshop On Weather Satellites

Washington—Meteorological service representatives of more than 100 foreign nations, including those from the Communist bloc, have been invited to a 10-day weather satellite workshop meeting to begin here Nov. 13.

Workshop is sponsored by the Weather Bureau and the National Aeronautics and Space Administration to promote understanding of the engineering aspects of the Tiros satellites and future weather satellite programs.

Ranger I Misses Planned Path; Systems Working in Low Orbit

Washington—Attempt to launch the Ranger I spacecraft into a deep space trajectory failed last week when the 675-lb. instrument package was injected into a low earth orbit.

The spacecraft was launched at 6:04 a.m. EDT Aug. 23 from the Atlantic Missile Range in the first use of an Atlas-Agena B launch vehicle by the National Aeronautics and Space Administration.

Separation of the instrument package from the Agena vehicle apparently occurred and the attitude control system appeared to be functioning. Also working well were spacecraft electronic components, and the flight provided a checkout for these instruments. Satellite lifetime was estimated at about 14 days.

Ranger I, a California Institute of Technology Jet Propulsion Laboratory project, was the prototype flight vehicle for rough lunar landings. Desired apogee was 685,000 mi. and perigee, 37,500 mi.

Single Burning Cycle

Reason for the low trajectory was not immediately determined, but there is a possibility that the Agena engine had only a single burning cycle. The engine was programed to ignite, shut down for a coasting period and re-ignite. NASA was studying the possibility that the Agena fuel was exhausted during the initial burning period.

Agena re-start capability has been demonstrated in Samos and Midas launches by adjusting the orbits of those satellites.

Ranger program presently consists of four more launches, the last three designed to impact on the moon. Discussions are under way which may lead to an increase of four or six such impact flights to obtain more information for the Apollo manned lunar landing program.

The 11-ft. Ranger spacecraft carried the following experiments:

- **Solar corpuscular** radiation analyzer, developed by JPL.
- **Six medium-range** particle detectors, five developed by the State University of Iowa and one by the University of Chicago.
- **Cosmic ray ionization** rate indicator, developed by JPL.
- **Triple-coincidence** cosmic ray indicator, developed by the University of Chicago.
- **Magnetic field analyzer** which was developed by NASA's Goddard Space Flight Center.
- **Solar ray detector,** developed by the Atomic Energy Commission's Los Alamos Scientific Laboratory and the Sandia Corp.
- **Neutral hydrogen** geocorona detector, developed by the Naval Research Laboratory.
- **Cosmic dust detectors** developed by Goddard.

Flight Sequence

Flight profile of the launch vehicle called for the Lockheed-built Agena B upper-stage to coast for 50 sec. after burnout of the General Dynamics Corp. Atlas.

The shroud around the Ranger payload was then to be jettisoned and the Agena's pneumatic control system was to have maintained the vehicle in an attitude horizontal to the earth. Then the Agena's restartable engine, developed by Bell Aerosystems Co., was scheduled to fire for 160 sec., followed by a second coast of 780 sec. in this 100-mi. high parking orbit. Attitude control was to have been effected by precessing the gyros 4 deg./min.

Second firing of the Bell Agena engine, for 85 sec., was to have happened then, taking the entire vehicle out of parking orbit and placing it on a translunar trajectory. At 150 sec. after final engine shutdown, the Ranger payload was to have been separated from the Agena, the latter being yawed 180 deg. by the pneumatic system 395 sec. later and slowed by the firing of a retrorocket.

Ranger was first scheduled for launch July 29, but with the count at T-27 min., a power failure at Cape Canaveral caused a postponement. Earlier in the count, a pressure regulator aboard the Agena had to be replaced.

Further Postponements

Launch was postponed again on three different days: July 31, at T-232 min., when the spacecraft leaked nitrogen control gas; Aug. 1, at T-15 min., when a faulty valve in the ground acid transfer van prevented full pressurization of the launch vehicle's helium tanks and the by-pass valve was found to be frozen; and Aug. 2, when a malfunction in the Ranger's command system caused the launch "window"—that period of days in which the relative positions of earth, sun and moon were favorable—to expire.

Commands for the execution of the experiments aboard the Ranger were to have been issued by an electronic solid-state timer, called the spacecraft controller.

Started 3 min. before launch, the controller was to have issued 10 commands:

- **1,500 sec.,** to increase the power being provided to the larger of the two transmitters, from 1.5 to 3 watts.
- **2,100 sec.,** to turn on those scientific instruments which had been shut down passing through the Van Allen radiation belts.
- **2,200 sec.,** to extend the radiation analyzer package, located at the end of a small boom, about 4 ft. from the main body of the spacecraft and to spread the solar paddles.
- **3,700 sec.,** to activate the attitude control system, the sun sensors, cold gas jets and the gyros. The system was then to lock onto the sun.
- **5,600 sec.,** to activate earth sensors, while still holding the sun-lock, and lock the vehicle onto this second reference point.
- **7,100 sec.,** to change the scale-factor of the telemetry, once the Ranger has been stabilized from the wobbling induced by separation.
- **12,000 sec.,** to change the scale-factor in one of the Iowa University devices, making the unit more sensitive to the radiation levels that are under measurement.
- **15,000 sec.,** to transfer the data being transmitted over the 3-watt radio from the omni-directional antenna to the directional antenna. The 0.25-watt radio was to have continued using the omni-directional reflector.
- **22,000 sec.,** to reduce the data transmission rate of the smaller radio.
- **22,200 sec.,** to activate a friction experiment, involving disks mounted on a motor-driven shaft, against which hemispheres of various metals and materials revolve. More than 80 different combinations were included in this experiment (AW July 24, p. 39).

Venus Probe Finds Solar Winds Slight

Soviet Venus probe launched Feb. 12 found only slight solar proton density outside of solar clouds, according to Dr. E. R. Mustel of the Astronomical Council of the Soviet Union.

He indicated that the outflow of gas from the sun is largely sporadic during solar storms, and if there is a steady solar wind it is extremely slight. The Ranger I spacecraft launched last week was to have made measurements of solar plasma, but the instrument package did not go into its planned trajectory (see p. 28).

Dr. Mustel said detectors on the Venus probe observed a single charged particle in a cubic centimeter of space. Measurements were made with a series of ion traps capable of detecting protons that have temperatures above 1,000F.

Teams Surveying Apollo, Booster Sites

By Edward H. Kolcum

Washington—U. S. lunar program last week moved into the politically sensitive area of selecting sites for the major laboratory and manufacturing facilities.

At the same time, the National Aeronautics and Space Administration was believed to be ready to organize the special management structure within the agency that is needed to handle the Apollo manned lunar landing effort.

NASA survey teams have been active in selecting sites for:

- **Manned space flight** laboratory center, consisting of about 1,000 acres.
- **Nova launch facility** (see box).
- **Launch vehicle fabrication** and test center.

There is some belief that the Apollo project will be managed by a committee headed by Dr. Robert C. Seamans, Jr., associate NASA administrator. Committee under this arrangement may consist of Robert R. Gilruth, presently director of the Space Task Group, who would be in charge of the spacecraft development and astronaut training; Wernher von Braun, director of the Marshall Space Flight Center, who would manage the launch vehicle phase; and Dr. William E. Pickering, director of California Institute of Technology's Jet Propulsion Laboratory, who would head the scientific effort.

Plan has been discussed to have systems integration responsibility retained at NASA headquarters under Abe Silverstein.

A previous plan was to appoint a well-known national figure to head the over-all program, but this idea apparently was scrapped because of a fear that it could have resulted in formation of an autonomous organization within NASA. It is believed that such an organization would dilute the over-all U. S. space effort.

Laboratory Committee

Four-man site-survey team for the manned space laboratory is headed by Jack Parsons, deputy director of NASA's Ames Research Center. Team consists of Phillip Miller of Goddard Space Flight Center and Martin Byrnes and Ed Campagna of the Space Task Group.

Called the Official Site Selection Committee, the group last week spent a day each at Jacksonville and Tampa, Fla., and Shreveport, La., and two days in Houston, Tex. This week the team is scheduled to survey other Texas sites in Victoria, Corpus Christi, Beaumont and Dallas-Ft. Worth.

Itinerary has not yet been made for further surveys, but sites in the far west will be inspected.

NASA has established as major criteria for its manned space laboratory water transportation, modern communications, excellent labor market, a supporting industrial complex, excellent community and educational facilities, electric power availability and a mild climate.

Peripheral criteria include the socio-economic impact of the facility on the area, site development costs, operating costs and availability of interim facilities until the laboratory can be built.

Space Task Group now is located at Langley Field, Va., and residents of the area have mounted a protest effort to keep the manned space flight group at Langley. But there is heavy political pressure to move the group to the Houston area. This effort is led by Rep. Albert Thomas (D.-Tex.) of Houston, chairman of the House Independent Offices Appropriations Subcommittee, which passes on NASA funds.

Space Task Group probably would prefer a Florida location, both for mild climate and proximity to the Atlantic Missile Range. STG spent more than $250,000 in travel in Fiscal 1961, much of it for trips to AMR. McDill AFB in Tampa was considered a leading possibility because the Air Force had planned to inactivate the base, but the inactivation has been postponed because of the world situation.

It is expected that the launch vehicle fabrication and test center will be located in Michoud, La., and either Houston or Tampa is near enough that capsule compatibility tests could be conducted routinely.

New Saturn Possible

Meanwhile, NASA's Marshall Space Flight Center is drawing up design criteria for the C-3 Saturn which will take the Apollo B spacecraft on circumlunar flight and the center is giving "very serious consideration" to an even farther advanced C-4 Saturn vehicle.

The C-4 Saturn, also called Saturn, Sr., or Nova, Jr., would consist of four F-1 engines in a cluster to form the booster and provide 6 million lb. thrust. There would be two hydrogen-oxygen upper stages.

The recently approved C-3 has a booster stage of two F-1 engines. No date has been scheduled for a pre-proposal bidders conference on this Saturn configuration, but preliminary phases for the vehicle program are under way.

NASA to Buy Nova Launch Site at Cape

Washington—National Aeronautics and Space Administration will acquire 80,000 acres of land adjacent to the Atlantic Missile Range in Florida as the site for at least six launch pads for advanced Saturn and Nova launch vehicles.

The site consists of all of Merritt Island north of Cocoa Beach, plus some land north of the existing AMR complex. There are about 3,500 individual parcels of land in the site, and President Kennedy was to ask Congress for an extra $60 million to purchase this property. Legal steps to acquire the land are expected to begin immediately. Extent of the acquisition is indicated by the fact that the north gate to AMR will be closer to Daytona Beach than to Cocoa Beach.

Construction will begin on the launch complexes in 6-12 mo. under the present plan and will continue for about two years. The new pads will accommodate:

- **Saturn C-3, C-4 and any other advanced Saturn vehicles.**
- **Liquid Nova vehicles with thrust ratings up to 12 million lb.**
- **Solid Nova vehicles with thrusts up to 20 million lb.**

Aviation Week predicted expansion of the Cape Canaveral area (AW July 31, p. 28) to meet the urgency of the manned lunar landing program.

Although NASA will purchase the land, it will be administered by the Air Force as part of the AMR complex. Current size of AMR is 15,000 acres and the administrative and flying operations area of Patrick AFB encompasses 2,000 acres.

Decision to expand facilities in Florida ends speculation on the Nova launch site. Survey teams had investigated potential launch sites in the Gulf Coast, at Brownsville, Tex., various equatorial sites and in Hawaii. Proposals for off-shore facilities also were discarded in favor of land launches.

Site survey teams were made up of NASA and Defense Department representatives, and Defense Secretary Robert S. McNamara concurred in the final decision.

AMR was selected for Nova because of water transportation accessibility, nearby air support facilities, potential speed of expansion in land acquisition and construction, clear areas for overflight, booster impact and over-all safety.

It has been estimated that an area 10 mi. in diameter may be required for over-pressure and noise protection for solid-fueled Nova boosters.

About 500 year-round residents live on the property to be acquired. Most of the land is used for orange groves, small farms, fishing camps and vacation cottages.

The Saturn C-1 booster which recently arrived at the Atlantic Missile Range was erected on its pad last Monday. Inert upper stages were being assembled on the booster Wednesday and Friday. At least eight weeks will be required for pad checkouts before the vehicle can be launched, but no static firings are considered necessary since the booster was static tested at Huntsville, Ala. First launch will be a ballistic flight down AMR.

Radio Frequency Demands Exceed Availability, OCDM Survey Shows

By Katherine Johnsen

Washington—Office of Civil and Defense Mobilization last week highlighted the unsolved difficulties involved in fitting adequate frequency allocations essential for U. S. space programs into the already crowded radio spectrum.

An OCDM survey of the plans of government agencies for use of space communications—earth-to-space, space-to-space, and earth-to-earth via space relay—disclosed that the total requirement for frequencies is substantially more than the availability, Fred C. Alexander, OCDM director of telecommunications, told the Senate Commerce Communications Subcommittee. The Interdepartment Radio Advisory Committee (IRAC), which is the President's agent for allocation of frequencies to government users, reports directly to OCDM.

It is now clear, Alexander said, that if the total estimated requirements of government agencies for space communications are to be met, "a major revision of government frequency allocations and possibly relocation of government radio operations might be necessary." Until a concrete program for space frequencies is developed, he said, OCDM is proceeding cautiously and assigning frequencies for non-space communications on a contingency basis.

Alexander reported two approaches to solve the space frequency problem:

- **OCDM has awarded** the Central Radio Propagation Laboratory of the National Bureau of Standards a one-year contract to study the entire usable radio frequency spectrum for the present and the next 10 to 20 yr. "with first emphasis" on the accommodation of space communications.
- **IRAC,** with the concurrence of Federal Communications Commission, has completed a report setting forth the "preliminary views" of the U.S. on space allocations. This is to serve as a vehicle for obtaining the ideas and reactions of other countries.

The hearings before the subcommittee, headed by Sen. John O. Pastore (D.-R. I.), produced evidence that increasing demands for frequencies for space and by private users are building pressure for release of bands held by the military services, some of them presumably on a stand-by basis for security. FCC estimates that it controls approximately half the radio spectrum for allocation to private users, with the other half under IRAC control. Other estimates have been made that IRAC's control now extends to as high as 70% of the spectrum.

Study to Be Sought

Sen. Pastore plans to ask the President—probably with a formal, written subcommittee request—to appoint a top-caliber task force or commission to study the policies of IRAC and FCC in the allocation of frequencies. Sen. Pastore's view is that some members of IRAC—notably Air Force, Army, Navy, Federal Aviation Agency and National Aeronautics and Space Administration—take the frequencies they want and leave the rest to FCC.

Sen. Pastore observed that government channels not now being used to the optimum could be turned over to other uses and requisitioned in an emergency.

Generally concurring with Sen. Pastore's outlook, Aeronautical Radio, Inc., protested the pre-emption of the 8,800 megacycle frequency by the military services and other government users for operation of airborne Doppler radar navigation systems, to the exclusion of commercial airlines. The Doppler device, giving a pilot an instantaneous indication of ground speed and course, was programed by the airline industry for installation in new turbojets starting in the fall of 1957.

Pointing out that the 1959 International Telecommunications Union treaty sets aside the 8,800-mc. frequency world-wide for airborne Doppler operations, Donald D. Beeler, representing Aeronautical Radio, told the subcommittee:

"If finalized, the result will be that government aircraft literally by the thousands . . . will be operating airborne Doppler radar systems . . . in the U.S. and throughout the world, but this privilege will be denied to civilian air transport aircraft.

"Also, foreign flag aircraft, with which our airlines compete, will have the benefit of this new airborne navigation device and treaty rights to operate it into and through the U.S. at any time or any place, but these rights will be denied to air transports of U.S. registry."

The 1959 treaty which establishes the Doppler frequency, also establishes for the first time definite frequency allocations—13 bands—for space communications. It has been pending before Senate Foreign Relations Committee for ratification since June, 1960. Beeler said the airlines look to this committee to bring about a correction of the present situation, under which they will be excluded from use of Doppler devices by U.S. government action.

Failure to ratify the treaty could have a serious adverse effect on the primary U.S. goal—to advance space communications technology and justify the allocation of frequencies for a global satellite communications system at the 1963 conference of the International Telecommunications Union.

The 1959 allocations for space communications were achieved under U.S. leadership—with modest support from the Soviet Union and Great Britain—over the reluctance and opposition of the majority of nations because of impingement on allocations for other services.

These allocations are considered minimum and, as OCDM's Alexander commented in last week's testimony, are "not intended to accommodate the large requirements of earth-satellite relay communications." Space communications have been and—until the 1959 treaty is effective—will continue to be on the basis of "non-interference" with allocations effective by international agreement.

NASA Ends MR Flights

Washington—Additional Project Mercury manned suborbital flights will not be made because test objectives of the program have been achieved.

The Redstone-boosted flights originally were planned as a pilot training device, but National Aeronautics and Space Administration said ground simulators can provide this training. Manned suborbital flights of Navy Cdr. Alan B. Shepard, Jr., and USAF Capt. Virgil I. Grissom validated telemetry readings taken on centrifuge profiles, procedures trainers and other Mercury simulators.

A new evaluation of all pertinent pilot data will be made to select orbital astronaut candidates, NASA said. All seven Mercury pilots will be considered for these advanced flights.

McDonnell Aircraft Corp. production capsules Nos. 15 and 16 had been assigned to the next two manned Redstone flights. They apparently will be diverted to the orbital program.

British Unveil Two New Light Plane Entries

London—Two new British business planes—a light twin and its single-engine version—are being designed by Beagle for initial flights early next summer.

The planes are the Beagle-Miles 218 four-seat twin executive and the Beagle-Miles 117 two seater version of the 218. They will be the fifth and sixth planes in the Beagle family, paced by the Beagle 206 twin which will be unveiled Sept. 4 at the annual Farnborough show of the Society of British Aircraft Constructors (AW Aug. 7, p. 29; Aug. 21, p. 35).

Design team, headed by George Miles, technical director of the Beagle group and chief engineer of Beagle-Miles, regards the 218 twin as a Gemini replacement. Price details have not yet been fixed but the twin will sell for about $14,000 and the 117 for about $5,600.

The airplane will have two doors, dual controls, and a steerable nose wheel. Powerplants will be two Rolls-Royce Continental O-200As of 100 hp. each, driving Dowty-Rotol McCauley variable pitch metal propellers. Dimensions are: span, 37 ft.; length, 25 ft. 3 in.; height 7 ft. 5 in. Gross weight is 2,750 lb.

Miles said design cruise speed is 150 mph. with a full-load range of 645 mi. Ferry range is 1,000 mi.

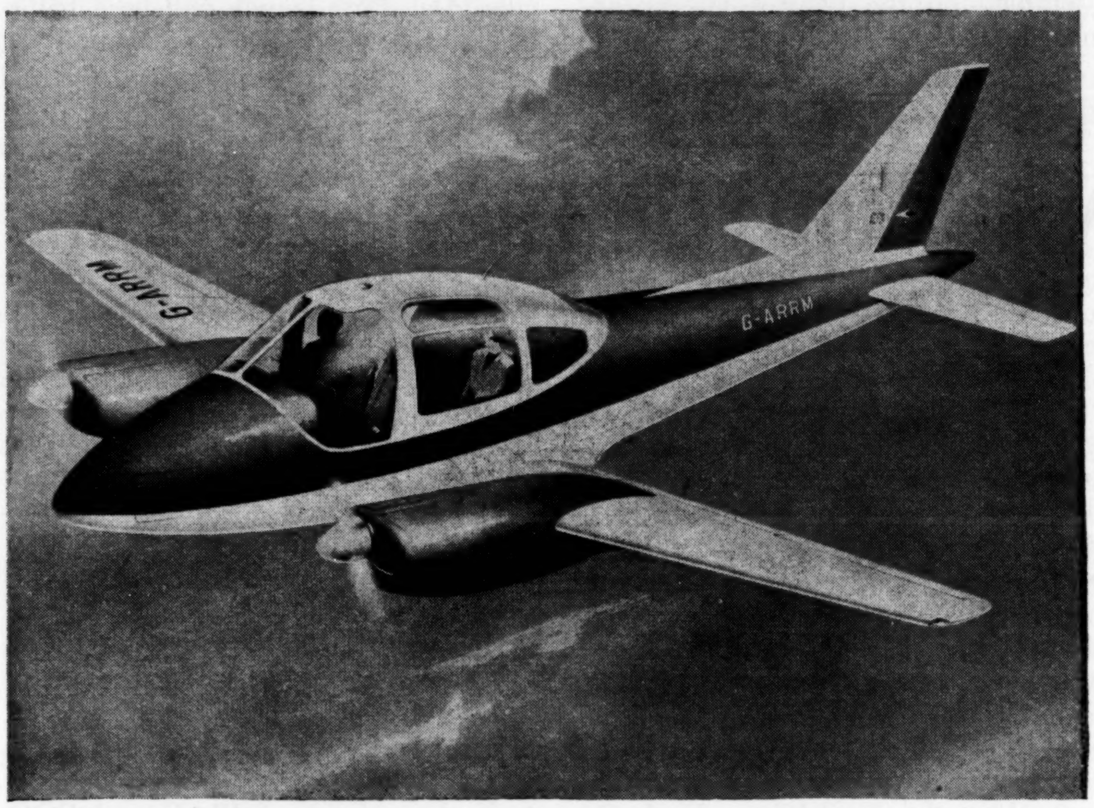
Three-Seat Conversion

The Beagle-Miles 117 single-engine version can be converted into a three-seater. Also tricycle geared, the track is quite wide, 11 ft. 8 in., for better ground stability. Normal cruise, using the O-200A powerplant offered, is 115 mph. Range with capacity payload is 270 mi. Dimensions are: span, 37 ft.; length, 26 ft. 1 in.; height, 7 ft. 5 in. Gross weight is 1,550 lb.

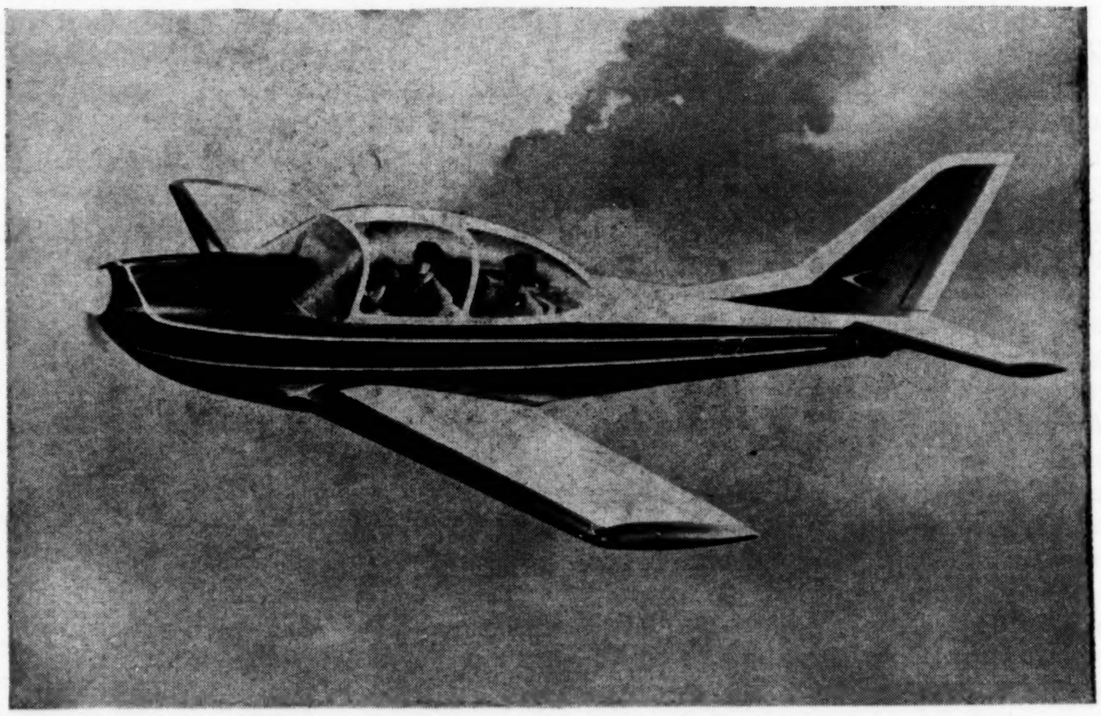
Spotlight currently will be on the new Beagle 206 executive twin, aimed at the world market with a United Kingdom price of "something under 30,000 pounds" or $84,000. Powerplants are two fuel-injection Rolls-Royce Continental IO-470D engines producing 260 hp. each and driving Dowty-Rotol McCauley full-feathering props.

Aircraft includes as standard equipment a complete toilet and wash-up facility. Design parameter set up 15 months ago after a market survey by Peter Masefield, Beagle managing director, envisaged all-weather flights up to 1,000 mi. in a 5-hr. journey time.

The 206 has a wide variety of cabin configurations. In addition to the basic five-seat version, the twin will be offered in six- and seven-seat layouts; a five-seat couchette; a five-seat pilot and navigation trainer; three-seat airline pilot trainer, and a two-seat, two-stretcher ambulance plane.



FIRST TWIN-ENGINE executive plane produced by Britain's Beagle group, the Beagle 206, is shown in this artist's conception in the five-seat configuration (above). Single-engine version of Beagle-Miles 218 twin powered by 100-hp. Rolls-Royce Continental (below).



The airplane was built in nine months.

Consultant on aerodynamics was Prof. A. D. Young, of Queen Mary College, London University. Interior was designed by Prof. Misha Black.

The 206 gross weight is 6,310 lb. Dimensions are: span, 38 ft.; length, 32 ft. 7 in.; height, 12 ft. 3 in. Wing has a dihedral of 5 deg. Maximum payload is about 1,000 lb.

Beagle says the payload can be hauled 1,150 mi. at an economical cruise of 228 mph. Maximum cruise speed is 242 mph. and maximum range is 1,720 mi. Airplane is designed to clear a 50-ft. obstacle in 685 yards (zero wind) and climb out at 1,840 fpm.

The airplane, along with others of the family, will be marketed world-wide by a sales organization being set up by Beagle at its headquarters at Shoreham Airport, Sussex. Beagle, which stands for British Executive & General Aviation, consists of four companies: Beagle itself, a subsidiary of Pressed Steel Co., Ltd.; Beagle-Auster Aircraft, Beagle-Miles Aircraft, and Beagle Aviation Finance, Ltd. An Air Service Division is maintained at Kidlington Airport, Oxford. The finance organization will handle both purchase and lease deals.

Other Beagle airplanes, all of which will be displayed at Farnborough are:

- **A109 Airedale** (AW May 15, p. 121), which has been repowered with a Rolls-Royce Continental GO-300 engine of 175 hp., replacing the Lycoming O-360-A1A offered on the standard version. This follows Beagle policy of using Rolls Continentals. The Airedale sells for $13,300 in a four-seat configuration. Gross weight is 2,750 lb.
- **Beagle AOP Mk. 11,** a follow-on of the Auster Mk. 9, designed as a private venture in collaboration with the British Army. It is powered by a 260-hp. Rolls Continental which has boosted takeoff power up to 50% to give the airplane STOL characteristics. New gross weight is 2,550 lb. with endurance pegged at 2.4 hr. Takeoff distance is under 100 yards and Beagle says the plane can land in less than 70 yards. Maximum cruise speed is 148 mph. and initial rate of climb is 1,630 fpm. Beagle, which hopes to sell the plane in high altitude operating climates, says the Mk. 11 can clear a 50-ft. obstacle in 385 yards from an airfield of 7,000 ft. elevation and 30C temperature conditions. Dimensions are: Span, 36 ft. 4¾ in.; length, 23 ft. 8½ in.; height 8 ft. 11 in.
- **A61 Terrier,** three-place sport and touring plane that is a development of the military Auster Mk. 6, with cabin soundproofed. It has been tested as a glider tug and Beagle says it will tow a 600-700 lb. glider, holding two persons, to a height of 2,000 ft. in about 6½ min. Powerplant is the de Havilland Gipsy Major 10, producing 145 hp., and sales price is $5,586. Normal cruise speed is 110 mph. and gross weight is 2,350 lb. Dimensions are: span, 36 ft.; length, 23 ft. 3 in.; height, 8 ft. 11 in.

Delta Puts Five Satellites Into Orbit In Year to Set Reliability Record

Washington—Highly successful Delta launch vehicle has demonstrated the greatest reliability of any U. S. space vehicle by putting five consecutive satellites into orbit within 368 days. Its only failure was its first launch attempt.

Latest mission for the National Aeronautics and Space Administration-Douglas Delta was to launch the Explorer XII energetic particles satellite into a highly elliptical orbit last Aug. 16. Since Aug. 12, 1960, the vehicle has launched Echo I, Tiros II and Tiros III and Explorer X.

Combination of these successes and expanded NASA weather and communications programs have vastly increased Delta's role in space plans (AW June 26, p. 32). If the requirement exists, the Douglas launch team can fire one Delta a month from each of two pads at the Atlantic Missile Range.

Although the original program called for 12 Delta launches, final negotiations are in progress to procure 24 vehicles, with more orders possible. Definite missions have been assigned to 19 Deltas, including two for the American Telephone & Telegraph Co.'s active communications satellite.

Hardware has been delivered to AMR for the next two Delta missions, both scheduled this year. They are the S-16 orbiting solar observatory and the fourth Tiros, designated Tiros D. Seven Delta missions are scheduled for calendar 1962. They are an atmospheric structures satellite, S-6; three Tiros satellites—E, F and G; two solar observatories, S-16a and S-17, and the S-3a energetic particles satellite.

The S-6a atmospheric satellite and a Tiros have been scheduled for calendar 1963. No schedule has been set for the AT&T satellites.

Vincent L. Johnson, Delta program manager at NASA headquarters, and William R. Schindler, Goddard Space Flight Center's Delta vehicle manager, said program management has few people and is streamlined, with direct communications to Douglas, AMR and the Air Force Systems Command's Space Systems Division, which procures the Thor first stage. Organization structure is a single manager at NASA headquarters, six people in the Goddard project office and 10 at Cape Canaveral.

The Delta program has a single prime contractor in the Douglas Aircraft Co., which is responsible for construction, checkout and launching. Government-furnished equipment includes the Thor—which Douglas builds—and the third stage Hercules-Allegany Ballistics Laboratory X-248 motor. Douglas builds or subcontracts the remainder of the Delta system, and assembles propulsion units and stages.

First Delta launch on May 13, 1960 failed because of malfunctions traced to the autopilot during the coast phase, incorrect firing sequence and failure of the third stage to ignite. As a result, the second Delta launch slipped six weeks and all components that contributed to the malfunctions were thoroughly examined.

Philosophy of upgrading system components remains a key part of the Delta program. Survey teams have succeeded in identifying what Johnson describes as "hundreds" of marginal components in visits to vendors and suppliers. Specifications and components have been modified to increase reliability in the marginal areas.

Schindler told Aviation Week the Thor has always been a good vehicle, "and we didn't make it any better. We haven't added or taken away reliability of Thor or of the second and third stages." The Aerojet and Hercules upper stages are essentially the Navy Vanguard upper stages. Major systems unique to Delta are electronics and flight guidance and control.

Thor has been used to boost 33 of the 47 successful U. S. satellites and probes. Boosters in the Delta system are standard Thor rockets, which are taken from the Thor assembly line and modified to compensate for airloads. Two standard shrouds have been designed for Delta payloads—a 32 in. dia. shroud for "slim" payloads and a 44 in. dia. shroud for larger satellites.

NASA uses the two Air Force Thor pads at AMR for its Delta launches and shares the pads with USAF. Thor was originally developed by USAF's Ballistic Missile Division as an intermediate range ballistic missile and is in operational service with the Royal Air Force in England.

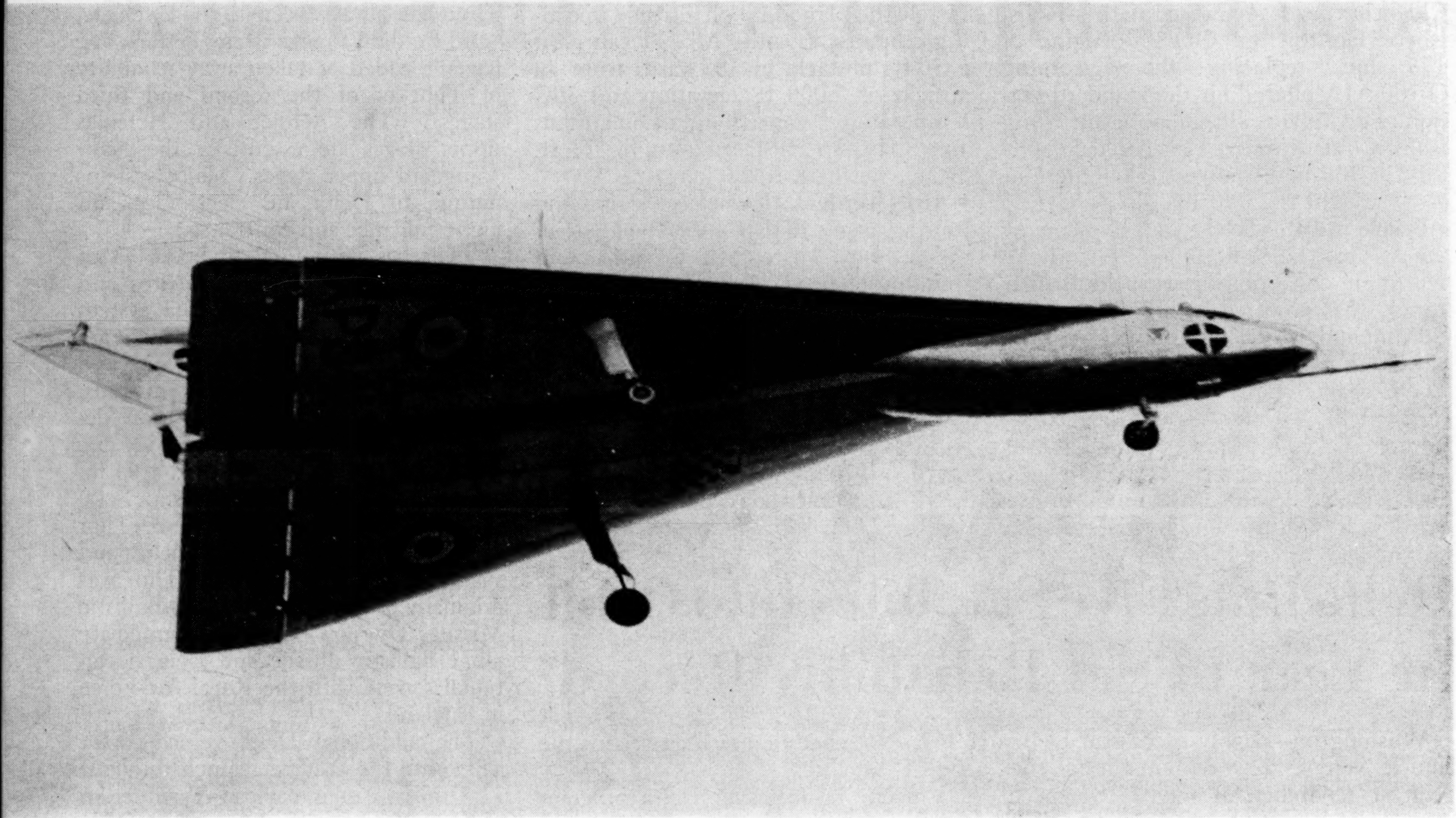
The additional Delta vehicle order will bring the cost per launch to about $2.5 million, plus payload—a reduction of $100,000 from the first order. Costs include vehicle design, manufacture, assembly test and launch.

Characteristics of the 92-ft., 111,500-lb. Delta are:

- **First stage Douglas-Thor,** powered by Rocketdyne MB-3 liquid oxygen/kerosene engine with a thrust of 150,000 lb. Launch weight is 107,000 lb. and burning time 160 sec. It is guided by a Bell Telephone Laboratories Radio command guidance system located in the second stage, and has roll and pitch programmers.
- **Second stage Aerojet-General** AJ-10-118, an improved version of the Vanguard second stage. Improvements are a BTL command guidance unit and a Douglas flight controller. Steel replaced aluminum in the thrust chamber. Second stage fits in the Thor adapter section, which splits into four petals after booster burnout. The engine weighs about 4,000 lb. and produces 7,500-lb. thrust during 109 sec. burning time.
- **Third stage ABL X-248** is a spin stabilized version of the Vanguard third stage. The 500-lb. solid motor, which burns 42 sec. and produces about 3,100-lb. thrust, is the same propulsion unit as the Scout fourth stage.

Second stage ignition and separation occur immediately after first stage burnout.

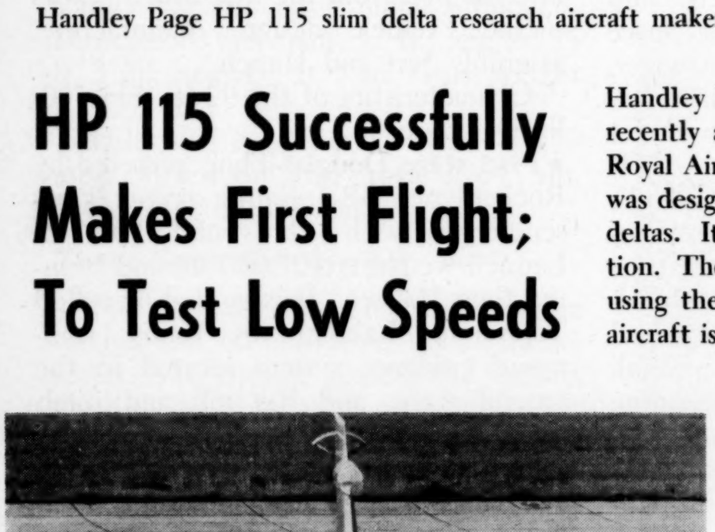
Douglas crew which conducts the Delta project at AMR is headed by W. H. Hooper, chief project engineer of Thor systems; Don G. Crews, Delta project engineer, and Gary F. Hanson, field station manager.

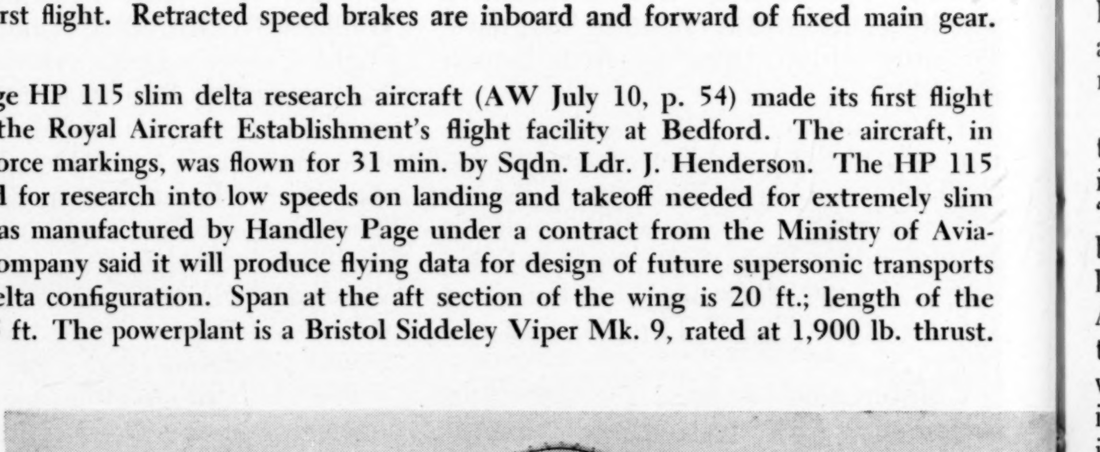


Handley Page HP 115 slim delta research aircraft makes first flight. Retracted speed brakes are inboard and forward of fixed main gear.

HP 115 Successfully Makes First Flight; To Test Low Speeds

Handley Page HP 115 slim delta research aircraft (AW July 10, p. 54) made its first flight recently at the Royal Aircraft Establishment's flight facility at Bedford. The aircraft, in Royal Air Force markings, was flown for 31 min. by Sqdn. Ldr. J. Henderson. The HP 115 was designed for research into low speeds on landing and takeoff needed for extremely slim deltas. It was manufactured by Handley Page under a contract from the Ministry of Aviation. The company said it will produce flying data for design of future supersonic transports using the delta configuration. Span at the aft section of the wing is 20 ft.; length of the aircraft is 45 ft. The powerplant is a Bristol Siddeley Viper Mk. 9, rated at 1,900 lb. thrust.





HP 115 is characterized by approximately 76 deg. wing sweep and rugged fixed gear, designed to take shock of extensive landing tests.

Navy Wants Ling-Temco-Vought To Build New Anti-Radar Missile

Washington—Navy's Bureau of Weapons has recommended the selection of Ling-Temco-Vought to produce its ARM air-to-ground, anti-radar missile, a scaled-down version of the Corvus missile which was canceled in July, 1960. Final Navy decision is expected by Sept. 1.

In an accelerated program made possible because most of the development work already has been done, requests for proposals which were mailed early in July resulted in replies from 40 companies. This field was quickly narrowed to 11.

Ling-Temco, the predecessor of Ling-Temco-Vought, had progressed as far as producing development models of Corvus in an $80-million program. Much of what was learned in guidance, logistics support, production lines design and target detection can be applied to ARM.

Size of ARM will be about that of the supersonic Sparrow III air-to-air missile. It will be capable of being launched from Sparrow racks and probably will use the same solid propellant motor.

Range of the missile will be a function of altitude. The higher the launching aircraft, the further the range. For "on-the-deck" missions the range would be up to five miles. Low-altitude lobbing tactics could increase the range. At 30,000 ft. the range would be extended to 25 mi. Higher altitudes would produce only small increments in range because of a steepening coasting trajectory.

ARM will be carried on all aircraft that can carry the Sparrow III and will have the capability of being launched supersonically. Its top speed will be Mach 3 at burnout.

For knocking out radar antennas, a conventional explosive warhead with no delay fuzing would be employed.

Cancellation of the Corvus occurred during a severe budget squeeze imposed by the Eisenhower Administration. Although $80 million had been expended on Corvus, whose range goal initially was 125 mi. with a growth factor to 200 mi., the program was estimated to cost $450 million over its lifetime.

Corvus had progressed to the point where launches were made over the Pacific Missile Range in operations conducted from the Naval Missile Center at Pt. Mugu, Calif. It was powered by a prepackaged liquid propellant. The program had not entered the production phase.

Much of the development work on Corvus was done by the Naval Ordnance Test Station at China Lake, Calif. After the Corvus cancellation NOTS began studies on a junior Corvus, which led to ARM. Most of the development work on ARM has been completed.

The ARM program is expected to last until the middle of 1963. It will involve a design improvement program to adapt the NOTS-developed vehicle to production and better its performance.

Ling-Temco-Vought, having already designed a prototype production line for Corvus, will follow along the same path in designing one for ARM. Then it will construct the line. While this phase is under way, several individually-produced engineering vehicles will be made, to be followed by an appreciable number of development models, also made by prototype production methods. Full-scale production will follow.

The contractor will also assist Navy in planning logistic support, further development of NOTS of the vehicle and developing operational data requirements.

Associated as subcontractors with Ling-Temco in the Corvus project were the Reaction Motors Division of Thiokol for propulsion, W. L. Maxson and Texas Instruments for guidance components, Williamson Co. for shipping containers, Horkey-Moore Associates for the launcher, Emerson Research Laboratory for target detection, Bulova Research and Development Laboratories for warhead safety and arming components and Talco Engineering Co. for the recovery system.

News Digest

USAF-Lockheed C-130E long-range turboprop transport made its first flight last week at Dobbins AFB, Marietta, Ga. At a gross weight of 155,000 lb. the aircraft can carry 17 tons nonstop from the East Coast to Germany or one stop to the western Pacific from the West Coast. The beefed-up landing gear permits operations from soft surfaced fields. It will become operational in March, 1962.

National Airlines' resignation from the Airline Mutual Aid Pact may force a change in the existing method of making strike payments. An original founder of the pact, National withdrew because it paid $400,000 to Eastern for losses Eastern suffered during a 10-day strike last year, but was able to collect only $78,000 from Eastern to offset losses from a 10-day strike against National this year. Benefits exchanged by the carriers were intended to cover revenue losses over competing route segments.

Continental Air Lines last week asked the Civil Aeronautics Board for an extension of its routes beyond Chicago to Cleveland and New York, with additional routes between Cleveland and Philadelphia and between Philadelphia and Detroit. Carrier said the new service is required by the competitive gap created on the route by the merger between Capital Airlines and United Air Lines.

Geophysics Corp. of America will perform a theoretical study of the motion of nuclear debris, following high-altitude explosions, under a $92,330 contract awarded by the Defense Department. Statistical model of the debris to be expected under varying conditions will probably be incorporated in the Vela Hotel program, space nuclear explosion detection system (AW July 17, p. 23).

Martin Co.'s Baltimore division has been awarded an 18-mo., $52,000 contract by National Aeronautics and Space Administration to study the effects of the space environment on non-metallic materials.

Chicago Midway Airport led the U. S. in total aircraft movements in Fiscal 1961 with 315,487, Federal Aviation Agency reported last week. Next in order were Washington National, Denver, Los Angeles and Tamiami Airport outside Miami, Fla. Midway also placed first in air carrier operations with 246,316 movements, followed by New York International, Washington National, Los Angeles and Chicago O'Hare. Washington National, topped the nation in itinerant and instrument flights handled. Midway also led in the same categories during Fiscal 1960.

Federal Aviation Agency reported last week that the number of passengers boarding U. S. trunk and local service airline aircraft in the 48 contiguous states increased from 49,357,870 in 1959 to 50,584,135 in 1960. Use of jets was responsible for the total number of flights dropping from 3,420,682 in 1959 to 3,343,989 last year. In international operations, passengers enplaning U. S. aircraft at overseas points reached 2,802,207—a 10% increase over the 2,553,560 recorded in 1959.

Civil Aeronautics Board last week awarded Pan American World Airways a new route from Tampa and Miami to Mexico City via Merida, Mex. The order specified that all flights must stop at Merida.

Southern Strike Stirs Pilot Discontent

ALPA members move to force decision by challenging their president; weigh censure, term reduction.

By David H. Hoffman

Washington—More than 4,000 Air Line Pilots Assn. members, dissatisfied with union efforts to end the 15-mo.-old Southern Airways strike, moved last week to force a special meeting of ALPA's 300-man board of directors to debate "radical and dramatic" action against the carrier.

Among the petitioning pilots are many who feel that ALPA President Clarence N. Sayen has neglected the "Southern situation" and, at the same time, paid too little attention to opinions voiced by the union's executive committee, master executive councils and rank and file membership on other key issues.

For this reason it is probable that, should the directors be summoned into special session, they will be asked to consider resolutions aimed at censuring Sayen—ostensibly for his recent trip to the Soviet Union (AW July 17, p. 52). Although Sayen was invited as president of the International Federation of Air Line Pilots Associations (IFALPA), policy enacted by the AFL-CIO executive council opposes all "free" trade union leaders visiting Russia.

Re-election Issue

A drive to limit the ALPA president's term of office to two instead of four years also is being planned by some prominent members in the association. If such a constitutional amendment passed in special session, Sayen might be forced to stand for re-election next year rather than in 1964. In this instance, almost certainly, he would be opposed by a sizable minority of ALPA's executive committee.

A resolution passed unanimously by Trans World Airlines Council 3 in Kansas City, Mo., is symptomatic of this most recent outbreak of discontent within ALPA. Alleging that trips such as Sayen's "contribute to the false propaganda by which the dictators of the Soviet Union convince naive and impressionable persons that true liberty and real unions are allowed to exist under communistic rule," the resolution requests the union's regional vice president to investigate why Sayen went to Russia, whether State Department approval for his trip was sought and obtained, and whether ALPA's executive committee approves "such activity by the president."

The regional vice president also was asked to obtain an investigation of ALPA's link with IFALPA. Such an investigation could result in ALPA's severing all ties with the international group "unless and until the representatives of the so-called Soviet civil pilots organization are barred from participation therein, whether as members of IFALPA or as observers at its meetings or conventions."

Pilots representing more than 30% of ALPA's roughly 14,700 active members were expected to sign petitions by late last week urging a union-wide ballot on whether to convene the board of directors in special session. But under ALPA's constitution, more than 50% of the union's membership must vote for a special convention before one can be called.

Ranking ALPA officials said last week that the intra-union furor over Sayen's Russian visit had attracted the interest of the State Department. According to one veteran captain, State wanted to have excerpts from the TWA Council 3 resolution broadcast by the Voice of America as an illustration of the political outlook and degree of freedom possessed by U. S. trade unions.

Newark Jet Ban Lifted

Port of New York Authority has granted permission to American Airlines and United Air Lines to operate turbojet equipment into and out of Newark, N. J. airport, subject to certain restrictions.

Newark previously has been closed to all put piston or turboprop aircraft. Gov. Robert B. Meyner of New Jersey earlier had approved the turbojet operation from the field (AW Aug. 21, p. 43).

Aircraft being operated by the airlines must not generate more than 112 perceived noise decibels and may not take off if calculations show a higher noise level will be created.

Initially, American will operate one Boeing 720B flight each day and United will operate three Caravelle flights daily.

Attempts by the Sayen administration to bring the prolonged Southern Airways strike to a union-approved conclusion so far have been unsuccessful. A temporary federal injunction barred pilots employed by other airlines from sympathy strikes in the 61 cities served by Southern. However, this injunction still may be challenged if ALPA's legal department elects to do so.

Federal Aviation Agency Administrator Najeeb E. Halaby has refused to restrict the carrier's operating authority after examining about 250 alleged flying safety violations filed against strikebreaking Southern pilots by ALPA (AW July 17, p. 49). Civil Aeronautics Board has refused to withhold federal subsidy from the airline, despite ALPA's charge that Southern was guilty of unfair labor practices in rejecting pilot offers to arbitrate points still at issue.

Intervention Refused

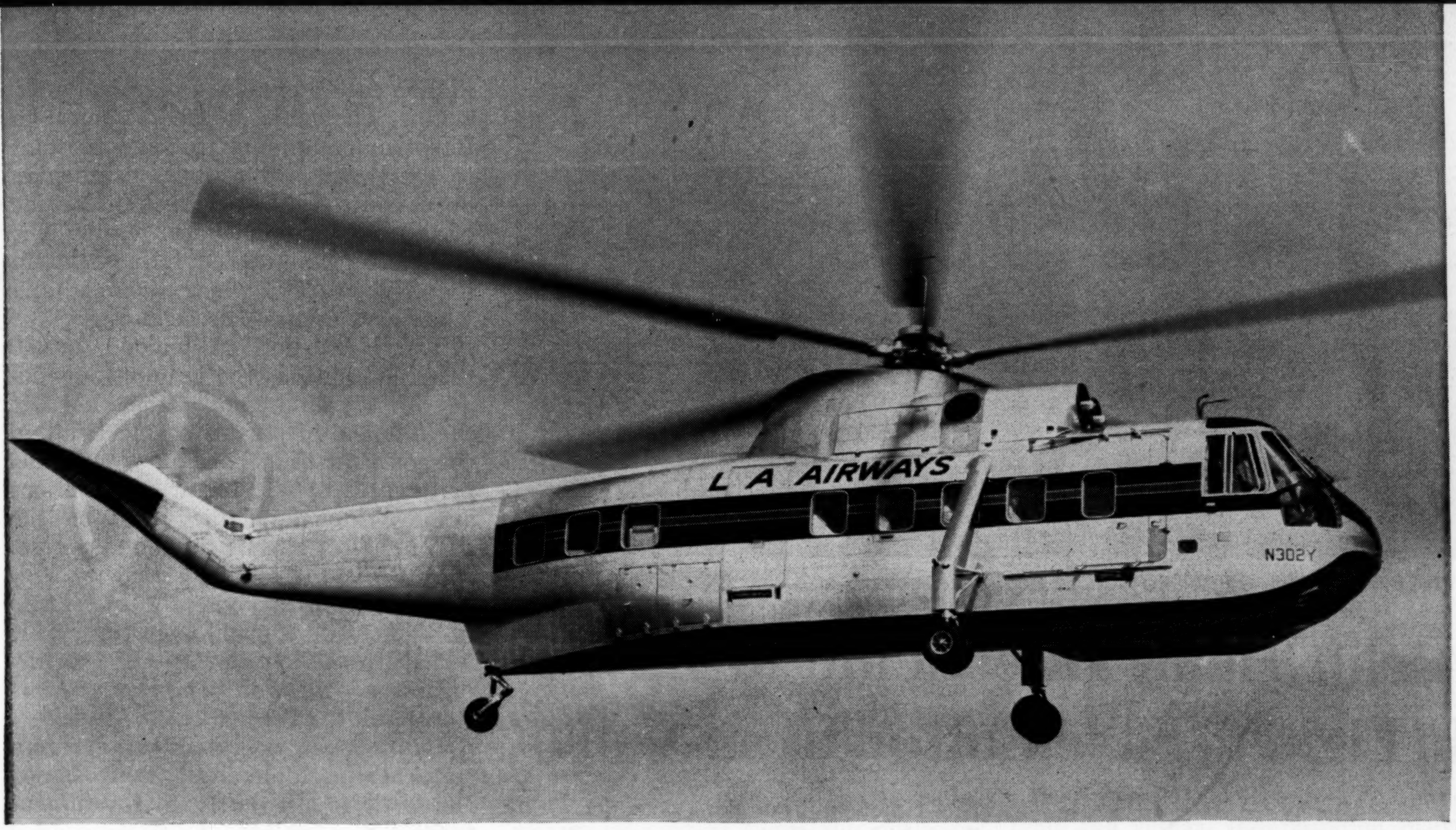
Finally, both Congress and the Department of Labor have refused to investigate the deadlock at Southern, which took shape after 147 pilots represented by ALPA struck the carrier last summer (AW Aug. 1, 1960, p. 38).

Even though this group now receives ALPA strike benefits ranging from $410 to $710 per month, patience of the individual pilots is near the breaking point. A July 13 letter forwarded to all ALPA councils by Southern Council 74 in Memphis, Tenn., reflects this attitude.

Claiming that their impasse with Southern's management "warrants much more attention than received in the past," the local council suggested that "dramatic action that inconveniences the public" may be required in order to get results.

The letter urged all other ALPA councils to encourage their members to "prepare to shut down all airline service throughout the U. S. if necessary to achieve victory." It termed the Southern situation a "cancer that will eventually destroy ALPA bargaining power with the larger trunklines."

An Aviation Week spot check of pilots holding elected positions within ALPA disclosed almost unanimous opposition to a nationwide strike. But these pilots were convinced that ALPA should accord the Southern situation a still higher priority, and that there should be no relaxation in union efforts to focus executive and legislative attention on the strike.



Los Angeles Airways' S-61L Scheduled for September Delivery

Los Angeles Airways' No. 1 Sikorsky S-61L twin-turbine helicopter, seen for the first time in the helicopter carrier's markings, will be delivered in mid-September. Most of the helicopter is unpainted for weight-saving, but a green stripe follows the window area and is bisected by a smaller red stripe with cream-colored outlining. Pitot tube extending from the rotor hub is experimental but two shorter pitot tubes will be installed permanently at the same location. Drum from which the pitot extends is a cover for strain gage installations for Federal Aviation Agency test purposes. Final certification of the aircraft is expected in September. Bulge on the hull just aft of the cockpit is caused by the enlargement of the forward baggage compartment included in the Los Angeles Airways' configuration. Compartment size has been increased to 62 cu. ft. from the 56-cu.-ft. version originally specified by the airline.

Berlin Stymies U.S.-Soviet Route Pact

Washington—Sealing of the East Berlin border is being given as the primary reason for the blunt refusal by the U. S. to sign a bilateral air transport pact with the Soviet Union for commercial air service between New York and Moscow.

This refusal, which came after two weeks of negotiations between the U. S. and Russian delegations in an unusually friendly atmosphere, was blamed officially by the State Department on the ". . . international situation, for which the United States is not responsible." But a State Department official said that the border closing was clearly responsible for this country's refusal to sign.

Asked why the talks had been allowed to continue when a policy had been set against signing the agreement, the official explained that agreement in principle had been reached on Aug. 7, and that State at that time had been willing to enter formally into agreement with the Russians, once a few technical details were ironed out.

On Aug. 13, the border between West and East Berlin was closed by East Germany. On Aug. 19, the U. S. decided this was "not an appropriate time" to conclude a pact.

Actually, the agreement had been initialed by U. Alexis Johnson, deputy undersecretary of State, and Gen. Y. E. Loginov, Soviet chief of the main administration of the civil air fleet. Purpose of initialing was to "record the conclusions reached between the two delegations," according to State.

However, James M. Landis, special assistant to President Kennedy and head of the U. S. delegation, said it is highly probable that, because of the U. S. decision not to sign, new talks may have to be held and the agreement renegotiated in its entirety before service on the route can be started.

Pan American World Airways, U. S. flag carrier designated to operate the route, and Aeroflot formally signed an agreement for the allocation of schedules, traffic restrictions, construction of maintenance facilities, tariffs, familiarization flights and other technical matters.

The Russian Embassy here told Aviation Week that the Soviet government is ready to sign the agreement any time the U. S. is. The Russians have been extremely anxious to begin the service as a part of their air route expansion program. Plans eventually call for an extension of the Soviet's proposed Atlantic route into Cuba and South America, although these aspects were not raised in the talks here.

In addition to the U. S. refusal to enter into agreement on the basic New York-Moscow route, one other obstacle stands in the way of Russia gaining air access to the Western hemisphere: decision by the Scandinavians to prohibit Soviet commercial aircraft from overflying Scandinavian territory.

The route was initially proposed as a gesture toward ending the "cold war" and plans to develop a civil bilateral air transport agreement were included in cultural exchange agreements of 1958 and 1959.

The decision to open negotiations on the route was reached in 1959 during talks here between Soviet Premier Nikita Khrushchev and former President Eisenhower.

When the Soviet Union broke up the Summit Conference of May, 1960, over the U-2 incident and then shot down a USAF RB-47 reconnaissance aircraft over the Barents Sea, the U. S. canceled the proposed negotiations. When the captured crew of the RB-47 was released last February, the U. S. proposed resumption of the talks. The Soviets agreed in June and negotiations began here July 18.

100-LB. BARRELS OF INSECTICIDE are loaded aboard a KLM DC-7C at Idlewild.

Airlift Hauls Insecticide to Egypt In Fight to Save Cotton from Worm

By Ward Wright

Large-scale commercial airlift involving 11 U. S. and foreign carriers, several supplemental airlines and the Military Air Transport Service has been flying around the clock to deliver more than 2 million lb. of insecticide to Egypt for use against army worms that are devastating the cotton crop.

The airlift began Aug. 6, two days after the government of the United Arab Republic placed a $2-million order for 2.25 million lb. of Sevin insecticide with the Union Carbide Chemicals Co. By the middle of last week, 1.9 million lb. of insecticide had been airfreighted to Cairo. Union Carbide officials expected the airlift to end late last week unless new orders were placed.

During the peak of the airlift, from 3 p.m. Aug. 18 to 9 a.m. Aug. 19, 11 airlines lifted 200,961 lb. of Sevin in 100-lb. barrels from New York's Idlewild Airport. Shipments on other days have averaged about 160,000 lb.

KLM, the major mover of the insecticide, had delivered 550,000 lb. by early last week, using a combination of DC-7F and Super Constellation air freighters. The airline also loaded insecticide into seats on Douglas DC-7C and DC-8 passenger flights that were returning deadhead to Amsterdam. It was transhipped to Cairo via other KLM cargo aircraft.

Swissair had moved 239,000 lb. of insecticide by early last week, carrying 13,000 lb. each in cargo compartments of its scheduled DC-8 flights. The airline was forced to seat-load the Sevin onto its DC-8 economy class cabins on passenger flights leaving during Aug. 15-17. Swissair transhipped the insecticide at Zurich and claimed 36-hr. delivery from New York to Cairo. On flights where passengers were seated in the same cabin, with seat-loaded 100-lb. barrels of Sevin they were advised "not to be alarmed by the strange looking passengers" strapped into the adjoining seats.

Pan American had airlifted over 240,000 lb. of Sevin by last week, with 89,000 lb. of the shipment going in the cargo compartments of its scheduled Boeing 707 and Douglas DC-8 jet passenger flights to London, Frankfurt and Rome. The remainder was moved by DC-7Fs and seat-loaded DC-7Cs. Pan American picked up shipments left in London and Frankfurt and flew them into Cairo with air freighters; the Rome shipments reached Cairo aboard six charter flights using DC-6 and DC-7 aircraft.

Largest seat load of insecticide went aboard a Scandinavian Airways System passenger DC-8 which was about to return to Copenhagen deadhead. The aircraft was loaded with 32,205 lb. of insecticide in 285 barrels which were stacked in every seat and in the ladies room. The aircraft departed with recorded music playing and hostesses aboard. SAS has flown 180,000 lb. of Sevin, mostly aboard scheduled DC-8 flights to Copenhagen, from which it was transhipped.

Irish International Airlines carried an estimated 90,000 lb. on its New York-London 707 jet flights, with about 11,000 lb. aboard each aircraft. The insecticide was transhipped aboard other airlines fom London. Alitalia flew more than 70,000 lb. to Cairo, with more than 50,000 lb. going aboard its scheduled DC-8 jet flights. The remainder was delivered by DC-7F air freighters and seat-loaded DC-7Cs that would have returned to Rome empty.

Urgency of the airlift was underscored by the steady destruction—estimated as high as one-third—of Egypt's $400-million cotton crop by a plague of army worms. The worm, a periodic threat to Egyptian cotton, has become resistant to DDT and hydrocarbon insecticides, but is controlled by Sevin, an insecticide of the carbamate chemical family. The insecticide was trucked from Cairo to the Nile valley, where workers and schoolboys sprayed the fields.

The UAR notified Union Carbide that it would pay the airlines individually for the air freight charges but left the problem of organizing the airlift to the company. The company's traffic department sent out inquiries to various airlines throughout the world on the availability of aircraft for the operation. Meanwhile, the company went on a 24-hr. day to manufacture the insecticide in West Virginia and New Jersey. It was delivered to Idlewild via a hastily organized "trucklift" employing everything from pickups to tractor-trailers.

Limited cargo capacity available in spite of the commercial airlift caused the UAR to ask the U. S. government for airlift assistance. U. S. responded with two MATS airlifts. The first left Andrews AFB, Md., Aug. 12 for Cairo with 60 tons of insecticide aboard five aircraft—C-118s and C-121s. The second left Dover AFB, Del., Aug. 12 and 13 with four C-124 Globemasters carrying 110,000 lb. of Sevin. State Department will negotiate with the UAR for payment for the airlift.

Other shipments carried by early last week: President Airlines (charter) 125,000 lb.; Trans World Airlines, 57,000 lb.; Sabena, 48,000 lb.; Air France, 34,000 lb.; Lufthansa, 24,000 lb.; Air-India, 12,000 lb.; Seaboard World, 10,000 lb. There also were charter flights by various U. S. supplemental carriers.

Losses of $13.5 Million Reported by Airlines

Washington—Domestic trunkline industry reported a loss of $13.5 million for the first six months of 1961, according to the Air Transport Assn.

The deficit was the largest first-half loss the industry has reported since 1947, when a net loss of $16.4 million was registered. Loss for the entire year of 1947 was more than $20 million.

In 1960, the trunkline industry reported a six-month loss of $5.3 million compared with net earnings of $30 million for the same period in 1959. Industry profit for the full year of 1960 was only $1.1 million.

Operating revenues for the first half of 1961 reached a record high of $979 million against revenues of $937 million in the same period of 1960. Operating expenses in the 1961 first half were $975.9 million, compared with $941.7 million in the corresponding period of 1960.

Second FEIA Walkout Feared As Feinsinger Completes Report

Washington—Industry concern over the possibility of another strike by the Flight Engineers International Assn. increased last week as a special presidential commission began preparing its final recommendations for settlement of the long-standing cockpit jurisdiction feud between pilots and engineers.

Prof. Nathan Feinsinger, chairman of a three-man group appointed to investigate the flight engineers' simultaneous shutdown of seven airlines last February, has concluded further talks with both pilot and engineer negotiating committees on Pan American World Airways and Trans World Airlines. He expressed optimism that the commission's final report may bring about a voluntary settlement of the dispute.

But Feinsinger did not reveal what further suggestions the final report may make beyond the commission's basic findings of last May 25 that FEIA should gradually merge with the Air Line Pilots Assn.; that turbojet flight crews should be limited to three men, and that flight engineers should be pilot-qualified. FEIA has flatly rejected these proposals.

With its membership reduced by a representative election at United Air-lines, where ALPA now represents the engineers, the loss of its chapter at Continental Air Lines after an abortive strike and the continued refusal of Western Air Lines to rehire engineers who walked out in the February strike, FEIA is unlikely to accept any proposals that may include those first recommended by the commission.

Pan American and TWA represent final test cases which the union feels will determine its future on American, Eastern and National—the remaining carriers with FEIA representation. Union hopes that the National Mediation Board might hand down a decision favorable to it were dashed when the NMB issued a recommendation that had the effect of transferring the problem to the Feinsinger commission.

Ron Brown, FEIA president, said he has informed Feinsinger of "our plans," and that FEIA will make "one last attempt" at signing a contract with Pan American. The union has been negotiating with the airline for more than a year and is legally free to strike Pan American and the other airlines involved in the controversy, Brown said. Contending that Pan American has "consistently clung to the government's coat tails and failed to bargain in good faith," Brown said his members were also angry over a memo written by ALPA President Clarence Sayen to the pilot union's board of directors.

Noting that the memo emphasized direct and indirect connections between ALPA and several Administration officials, Brown said: "We feel that because of the content and certainly the innuendo of the Sayen memorandum, we must now pursue our own course of action under the Railway Labor Act."

Brown gave no indication of what was discussed with Feinsinger, but informed observers feel that a monthly flight time reduction proposal may be a key issue that will be placed before the airlines.

No mention of this request was contained in Feinsinger's original recommendations, although it was suggested earlier to the commission by FEIA. Feinsinger's attempt to settle the labor dispute by a union merger has not been accepted by FEIA, and many facets of the recommendations are not completely acceptable to ALPA. The variety of solutions offered, some observers argue, are likely to give individual airlines a greater freedom of choice than either union.

Feinsinger's early recommendations also criticized the airlines severely for permitting the labor dispute to grow and for failing to make a strong stand rather than bowing to the demands of both unions and employing four-man crews on turbojets.

On this basis, speculation is now growing that the reduced monthly flight time issue may be a keystone in the next commission report, which would have the effect of placing the responsibility of settlement of the dispute with airline management.

Hijack Bill Approved By 375-5 House Vote

Washington—House last week passed by 375 to 5 a bill to impose criminal penalties including death on persons found guilty of hijacking aircraft.

The bill is similar to the one passed by the Senate (AW, Aug. 14, p. 47). A major difference is that the House bill contains a definition of air piracy while the Senate measure relied on definitions in existing maritime laws.

The House bill defines aircraft piracy as " any seizure or exercise of control by force or violence or threat of force or violence and with wrongful intent of any aircraft in flight in air commerce." Penalties range from 20 years' imprisonment to death.

Chairman Oren Harris (D.-Ark.) of the House Interstate and Foreign Commerce Committee said "legislation, of course, is not going to prevent aircraft piracy, but the stringent penalties provided in this legislation will make all but the hopelessly unbalanced stop and think before they commit a crime which might well bring them to the electric chair."

The House bill also provides penalties of up to 20 years' imprisonment and $10,000 fine for persons found guilty of threatening or assaulting any members of the aircraft's flight crew. Fines and imprisonment up to one year are provided for persons carrying concealed weapons. The air carrier under the House bill could refuse transportation to anyone who it felt "would or might be inimical to safety of flight."

TWA Promotes Hall To Operating Chief

Trans World Airlines last week named Floyd D. Hall, former vice president and general transportation manager, to the position of senior vice president and system general manager in a major reorganization of its top management. At the same time, Warren Lee Pierson, former chairman of the board of directors and head of the executive committee, announced his retirement from active service.

Hall succeeds E. O. Cocke, who has been named senior vice president-industry affairs—a newly created position that will embrace public relations, community relations and interline matters. Cocke will serve as senior counselor to the president, Charles C. Tillinghast, Jr., and will handle special assignments.

Under the plan, Hall will rank second to Tillinghast and will serve as general manager of the company's operations. Pierson will remain a member of TWA's board of directors.

Cocke also will handle a number of responsibilities formerly covered by Pierson. Reporting to Cocke will be Gordon Gilmore, vice president-public relations; Ronald Duckworth, corporate secretary and director-associated airline affairs; and J. R. Barch, assistant vice president-industry association affairs. Barch will be responsible for matters pertaining to the International Air Transport Assn.

J. E. Frankum, formerly general manager of transportation in the Atlantic region, has been named vice president and general transportation manager. The technical services department was moved into the status of division to rank it with the transportation and sales divisions. All will report directly to Hall.

Title of vice president-Washington affairs, held by Thomas K. Taylor, is changed to vice president-government affairs.

PASSENGERS BOARD FRONTIER Convair 340 at Jackson, Wyo. Airline operates seven 340's and expects to convert them to turboprops.

Frontier Seeks Subsidy-Free Operation

By Robert H. Cook

Denver—Abandonment of unproductive points and expansion of its present route system to more heavily populated cities in the Southwest forms the basic strategy of Frontier Airlines' plans to become a subsidy-free operation.

Frontier is the largest of 13 local service airlines, with a route system of 6,000 mi. serving 63 cities in 11 states. The airline has continuously raised year-end revenue figures to new heights, but it feels that it cannot achieve its full growth and profit potential until it is removed from the Civil Aeronautics Board restrictions applied to subsidy collectors.

A staunch advocate of the Board's "use it or lose it" policy, President Lewis B. Maytag, Jr., estimates that 32 of the airline's 63 cities fail to meet the CAB requirement that local airline service be provided only to communities which enplane an average of five passengers a day. While the airline recently dropped service to several communities which collectively produced less than 60 passengers a month, the remaining percentage of loss points is high compared with most local service operators.

Illustrating this point, Frontier points to such communities as Imperial, Neb., (pop. 1,563), which has been producing an average of only 11 passengers a month on a daily service schedule of two round trips. Other typical examples are Lewiston, Mont., with 54 passengers a month on one daily round trip and Lemmon, S. D., which boarded an average of less than 23 passengers over a one-month period.

Predominantly a north-south carrier, Frontier has a route system following the Rocky Mountains and stretching from the area of the Canadian border to southern Arizona and New Mexico. The average passenger haul on the airline of 280 mi., one of the highest among the locals, is largely offset by the meager traffic producing potential of its route system in such areas as Wyoming, which has a total population of less than 300,000. Frontier serves nine towns in this state and realizes an average fare of $20 per passenger.

The problem is even more acute to the North, where Frontier is negotiating to end service to 13 cities in Montana, North Dakota and South Dakota, after experiencing unprofitable operations to these points for more than two years.

Route Sale

Rather than undergo a lengthy CAB hearing, Frontier has asked the Board to approve the sale and transfer of route segments between these points to North Central Airlines as a practical extension of the North Central system, which now provides service on a northern route through the Dakotas into Minneapolis-St. Paul. Transfer of these routes, which did not fit into Frontier's predominantly north-south pattern, is expected to drop Frontier's annual subsidy bill by $1.3 million and would give residents of these cities their first one-carrier service into the Twin Cities, Frontier contends.

Attempts by the carrier to divest itself of poor traffic points also have brought into focus the growing local service industry problem of state vs. federal authority.

This has been the case in Nebraska, where Frontier attempted to drop its Segment 13 service between Casper, Wyo., and Omaha, Neb., via Chadron, Valentine, Ainsworth, Norfolk, Columbus and Lincoln. Suspension was granted by a CAB examiner, but the airline has been forced to retain the service under a court injunction obtained by the state last September.

During an appeal hearing before the full Board, it was estimated that service along the route accounted for $428,000 of Frontier's annual subsidy bill of about $6 million, or $3 in subsidy for each $1 of revenue produced by the route. The state has countered with a proposal that direct service between Chadron and Lincoln be retained at an estimated subsidy cost of $148,000. A final Board decision is expected soon.

Frontier is not sure, however, that an affirmative decision from CAB would put an end to the dilemma. Frontier has deleted the route from its system route maps, but has continued the service without any subsidy payment for this segment. Should the Board issue a formal cease and desist order to drop the service, the state might seek further delaying actions in the courts. Frontier is optimistic that the Nebraska State Railway Commission, which has been fighting the service abandonment, may accept the Board's final decision.

G. Ray Woody, executive vice president of Frontier, sees this problem as one of the major obstacles to the airline's growth. Pointing to the relatively small populations of most of Frontier's major cities, he said that expansion into areas of high population growth potential is a must.

The class mail rate system of subsidy payment, under which Frontier has been operating since July, holds great promise for greater management flexibility and ingenuity, Woody said, but the system may be forced to undergo several refinements before its full value can be assessed.

One problem with the new system, which pegs payments to a direct plane mile cost per station served, is that while several intermediate stations may be dropped, lowering subsidy, the actual mileage along the route may remain virtually the same with little change in operational cost to the carrier. This mathematical complexity, Woody feels, has encouraged many local service operators to retain low traffic points rather than run the risk of failing to recapture full operational costs.

To accelerate the airline's growth rate and eventual freedom from subsidy, Frontier needs a series of new routes fanning southward from its Denver headquarters to Albuquerque, N. M., El Paso, Texas., Tucson and Phoenix, Ariz., Las Vegas, Nev., and Los Angeles, Calif., and wants a direct route between Salt Lake City, Utah and Phoenix.

Acquisition of these points, already applied for under the Southwestern Area Case and the Southern Rocky Mountain Case, would give Frontier the access to heavy population centers which it needs, permitting a greater exploitation of its scenic attractions and less dependence on tie-in promotions and connections with major trunks in these areas, Woody said.

New Problems

While the turbojet re-equipment programs of the trunk carriers have benefitted the public, Woody also contends that this very progress has created new problems for most local service operators. Already losing much short-haul traffic to improve highway systems and parallel mail routes, local service airlines are experiencing new scheduling problems in an attempt to accommodate passengers who want to make turbojet connections on trunks. Rather than take a local flight which does not make a close connection with such service, Woody said, many potential passengers now drive to the nearest trunk terminal.

Frontier now operates 7 Convair-340s and 25 Douglas DC-3s, crossing the Continental Divide 23 times every 24 hr. It expects to phase out most of its Douglas equipment, convert the 340s to turboprop power and purchase British Aircraft Corp. BAC-111 turbojets if its route applications are granted.

Frontier signed a letter of intent in July to purchase six BAC-111s for delivery beginning in 1965, on the condition that a firm final order will be signed by the first of next year.

LEWIS B. MAYTAG, JR.

Operational flexibility and economy are the major reasons for the interest in the twin-engine, aft-mounted turbojet, which Frontier feels would be ideal for operations from many points on its system which are at altitudes ranging from 3,000 to 7,000 ft. Frontier made a detailed analytical cost comparison of the BAC-111's projected operating figures and compared this with the Air Transport Assn. cost formula as applied to Frontier's actual route segments. Cost projections for the British turbojet worked out to within one cent per plane mile difference, Woody said.

Meanwhile, the airline has concentrated on getting the maximum revenue from its present route system. Revised budget procedures last year resulted in a $1-million decline in Frontier's expenses, while gross operating revenues reached $13.7 million as compared with $11.8 million in the previous year. In the 12-mo. period which ended in July of 1961, the carrier's average system load factor reached 39.7% as compared with 36.7% for the previous year. The airline's revenue plane miles flown in 1960 increased 51% over 1958, while operating revenues recorded an 86% gain in this same period.

Frontier has also stepped up its tour promotions to such scenic areas as the Grand Canyon, the Black Hills, and the Grand Tetons, with promotional brochures quoting tour services and prices, along with "gimmicks" such as samples of salt from Salt Lake, stone from the Mt. Rushmore memorial in the Black Hills and turquoise stone from Mesa Verde. Last year, tie-in tours with major trunks brought Frontier an estimated 3,000 passengers, most of whom arrived from the East on American Airlines and Trans World Airlines. Current promotions are being linked to the Visit USA program and the airline is completing new promotions with Lufthansa and other foreign flags.

200 Workers Strike Bankrupt British Line

London—Overseas Aviation (C.I.), Ltd., major British independent forced into liquidation by British Petroleum and Rolls-Royce for nonpayment of debts, last week was negotiating with British United Airways for sale of its Gatwick hangar, following a work stoppage of 200 mechanics there.

Meanwhile, disturbed over adverse publicity, the Independent Air Transport Assn. said its 13 member airlines were working with travel agents to return passengers who had flown to European holiday spots via Overseas Aviation. The airline's planes now are grounded.

The work stoppage occurred when the Gatwick mechanics demanded further details on their financial future with the airline. A number of workers have already joined BUA.

In another move, Overseas Aviation filed a writ against British Petroleum, claiming damages for an alleged breach of contract to supply aviation fuel. Writ has not yet been answered.

Overseas Aviation's debts total about $2 million, of which about $700,000 each is owed to Rolls and British Petroleum. The airline, formed in 1958 by Ronald Myhill, primarily does group charter work and has applied for 11 scheduled routes to the continent in opposition to British European Airways.

Move to recoup the debt was initiated by British Petroleum, which cut off fuel supplies to Overseas Aviation at Gatwick Airport at a peak traffic time for the airlines.

Myhill said Overseas had been paying about $5,000 a day on its fuel bill, but BP countered that the payment was for current gallonage and did not apply to the back debt.

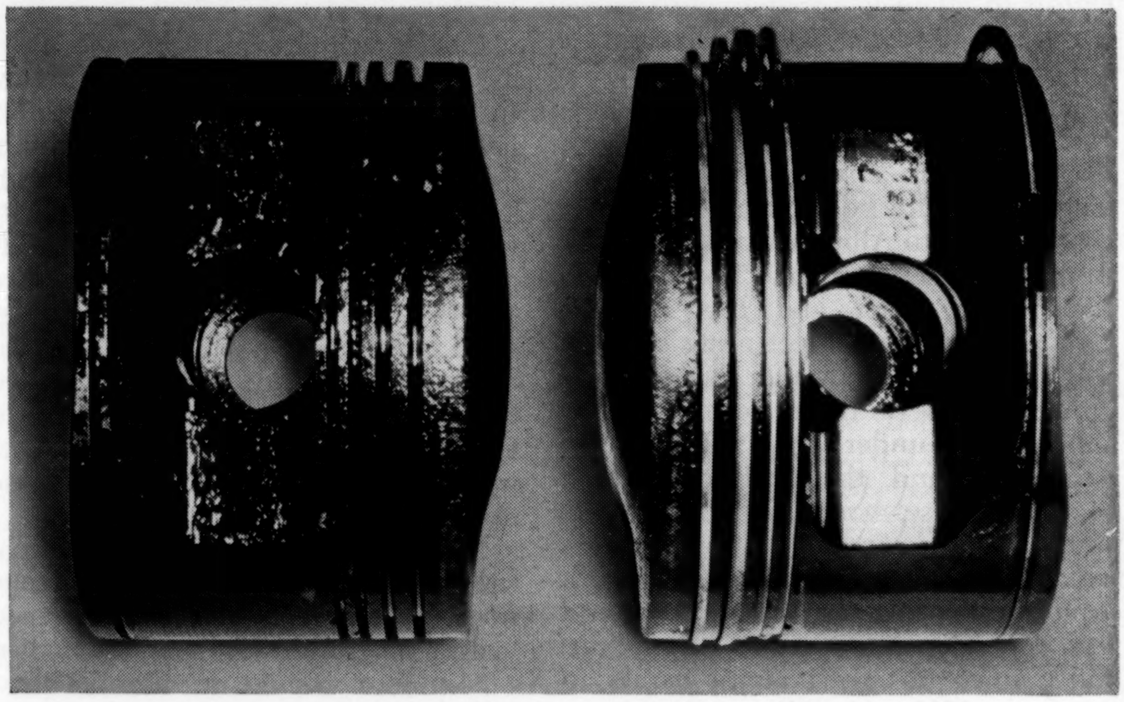
BP's move was quickly followed by Rolls-Royce, which declined to give a figure on the Overseas debt except to say it was "comparable" to BP's. Overseas owes Rolls for engine repairs and overhauls at the Rolls Glasgow facility and has done so, the engine firm added, "over a considerable period of time."

The airline has a number of lesser debts, the most important of which is to BEA for purchase of three Elizabethan transports. Overseas owes BEA about $12,000 on a contract totaling nearly $140,000 and the installments had been paid up to the time of initiation of liquidation proceedings.

Overseas said its difficulties resulted from some "uneconomic" operations, capital investments in airplanes (15 North Stars were bought from Trans-Canada) and the difficulties of splitting operations between Gatwick and Southend.

BULLETIN:

AeroShell Oil W becomes first fully compounded additive oil to win approval of every major aircraft piston engine manufacturer in the U.S.



Left: Piston from engine using straight mineral oil after 1,000 hours; note sludge and coke. *Right:* Piston from same aircraft after 1,000 hours on AeroShell Oil W.

Aircraft, large and small, have logged millions of flight hours on Shell's new additive oil—the first fully compounded additive oil approved by every major U.S. manufacturer of aircraft piston engines.

Here are answers to 10 key questions about AeroShell® Oil W—how it helps keep engines cleaner, reduces wear—even extends periods between engine overhauls.

1. What types of aircraft can use AeroShell Oil W? Piston engine planes of any size. Helicopters, too.

2. Why is it called a non-ash dispersant oil? Because it contains special metal-free additives that help keep tiny, ingested particles in the oil from clumping together and forming deposits. These particles remain suspended and dispersed.

3. How does this affect engine performance? It means that engine parts stay cleaner. That lubrication points get all the oil they need. *Your engine can run more efficiently, parts can last longer.*

4. What about oil consumption? Because AeroShell Oil W helps provide a cleaner engine and less wear, you can expect less oil consumption.

5. Can AeroShell Oil W reduce maintenance costs? If you have been using a straight mineral oil, AeroShell Oil W can reduce your maintenance costs substantially. Intervals between engine overhauls can be extended.

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7. Is AeroShell Oil W thoroughly proved? Thoroughly. It's had millions of engine hours of flight time.

8. Can AeroShell Oil W be added as a make-up oil? Yes. It is compatible with all piston engine oils now being used.

9. Is there more than one viscosity grade? AeroShell Oil W is available in *three* viscosity grades: 100 and 120 grades for large engines. And 80 grade for small engines where straight mineral oil grade 55, 65, or 80 is normally recommended.

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Boyd Impresses Airlines as CAB Chief

By L. L. Doty

Washington – During his first six months as chairman of the Civil Aeronautics Board, Alan S. Boyd has impressed the airline industry as an able administrator who has quickly grasped the intricate problems behind the industry's current financial and traffic dilemma.

In an Aviation Week survey of airline reaction to the new chairman, criticism dealt with only one major area —international air transportation—a field in which, ironically, Boyd is intensely interested. There was some opinion that Boyd has made some bold and promising statements in speeches which have not been followed by specific action, but this criticism was modified by a feeling that it is still too early to make a final judgment.

Generally, Boyd emerged as an administrator who, in the words of one airline official, "has already manifested a desire to strip red tape and rapidly move to the core of major issues." Boyd joined the CAB as a member in December, 1959 and was named chairman by President Kennedy in February, 1961.

The survey disclosed no feeling that Boyd has introduced any revolutionary policies that can be expected to reshape the face of the industry. In general, the impression is that Boyd has strengthened the CAB by enabling it to act on issues before it with expedition.

Scrapping Old Policies

On the other hand, there is general belief that Boyd has already injected a philosophy into the CAB which ultimately will ease many of the traditional policies of the past into oblivion. For example, Boyd told Aviation Week that he sees no need for granting any more major routes to domestic trunkline carriers beyond those under consideration in pending cases. Obviously, this position will eliminate the longstanding policy of strengthening smaller carriers by stiffening competition against large carriers through route awards.

In the current United Airlines Competitive Service Investigation, the order is worded in such a way that any new competition added to routes on which United holds a monopoly will be limited to one carrier, not several—a real innovation in the light of past route investigation cases. Another prevailing opinion is that the Board has eased its stand, once virtually inflexible, that it should dictate scheduling policy to the airlines in adequacy of service cases—another field in which Boyd is especially interested.

Boyd is a strong supporter of promotional and excursion fares and he undoubtedly will back all reasonable fare reductions proposed to generate traffic in new markets. He told Aviation Week that it is now clear that the domestic carriers are "making a genuine effort to promote air transportation" through the use of lower rates.

He said that the industry has "just about soaked up all the traffic that is available from other common carriers" and added that normal population growth and diversion from the private automobile are the two most promising sources of new traffic.

Boyd is a strong advocate of the show-cause device. He feels that use of the show-cause order, as in the United States-South America Route Case, gives the airlines an opportunity to understand the thinking of the Board on issues at stake. A similar show-cause order in the North Atlantic area can be expected soon, in line with this philosophy.

Industry Doubts

A few veterans in the airline industry are inclined to doubt whether Boyd will be able to follow through on some of the proposed programs he has offered in his public statements. One official said that an "early flurry of new-broom promises" is meaningless and that "time usually brings about a settling of the dust."

However, the majority feel that Boyd is capable of carrying out his plans and that he bears the strength to make his influence felt both on the Board and in the staff.

One airline attorney said Boyd has shown a "fervent desire to learn all about a given problem before he even attempts to deal with it." Another noted that the chairman already has challenged the White House on "one minor issue." He said this may be an indication that Boyd will not be deterred in his drive for improvements in industry regulation no matter how politically involved a problem may become.

On the contrary, a minority felt that Boyd may be too "politically conscious" and may have a tendency to steer clear of issues with political overtones. This feeling was particularly noticeable in discussions with representatives of carriers operating international routes.

This group was virtually unanimous in its opinion that Boyd had failed to take adequate action in the international field. One official said Boyd had been "disappointing" because he had publicly given verbal assurance that some move will be made to protect U. S. flag carriers against the competition of foreign flag carriers and "yet no action has been taken."

Another official, who stamped Boyd's record on domestic issues as "Grade A," said that Boyd was long overdue in improving the international situation, and said it was his opinion that Boyd appeared unwilling to move into the arena where the Federal Aviation Agency, the State Department and the White House were jousting for a dominant position in this field.

In a speech delivered last month in San Francisco, Boyd called for "drastic action" in the international field and said that "there must be reappraisal of our agreements and the conduct of all parties under them." Boyd told Aviation Week that Board action will be guided by a study being conducted by the Board and by studies conducted under Project Horizon.

He said that there are too many foreign flag carriers operating in competition with U. S. carriers through U. S. gateways, but he sees no solution to this problem because of the reciprocal nature of bilateral agreements. Boyd said pooling may be the answer, but he noted that, while such a solution is physically possible, it is not necessarily politically practical since it is contrary to U. S. public policy.

Boyd does not feel that self-control of capacity and frequency is possible because of the economic requirements of air carriers. He emphasized, however, that foreign carriers should understand the "rules of the game" and that some form of control must be established to prevent continued diversion of traffic from U. S. carriers.

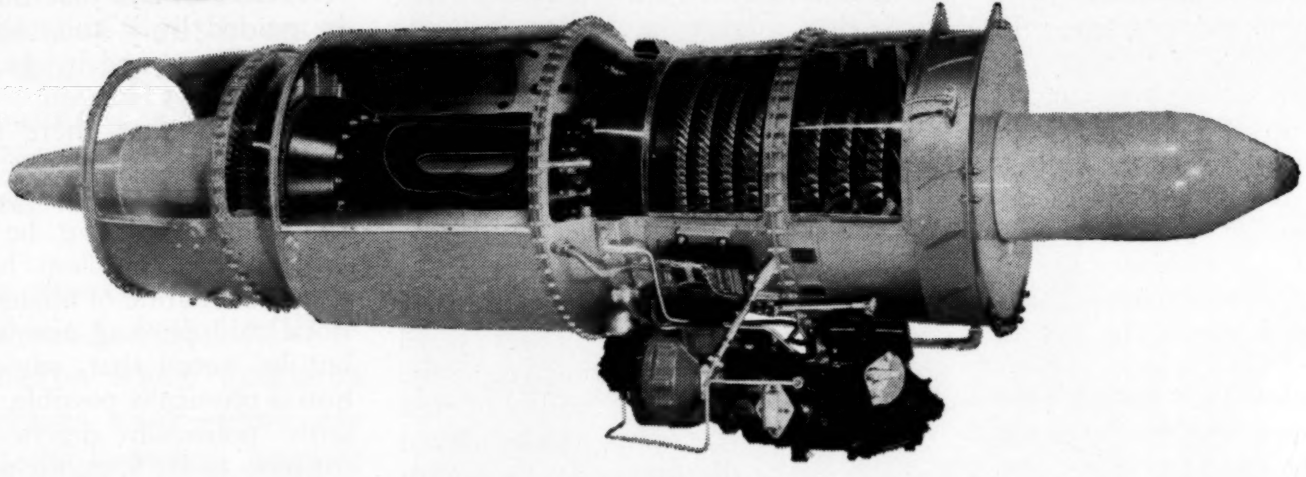
Two Carriers Report Losses in First Half

Allegheny Airlines and Braniff Airways last week reported net losses for the first six months of 1961. Braniff, with a first-half deficit of $579,424, attributed its loss to international operations. Allegheny reported a net loss of $223,832 but expects profits to hit a peak in the third quarter.

Braniff reported total revenues for the six-month period of $43 million compared with $41.6 million for the same period last year. International operations were responsible for a loss of $603,421 and domestic losses totaled $23,997.

Allegheny showed a net profit of $347,881 for the second quarter of the year compared with a net loss of $40,576 in the same period last year. Load factor in the first six months was 42.1%.

JT12



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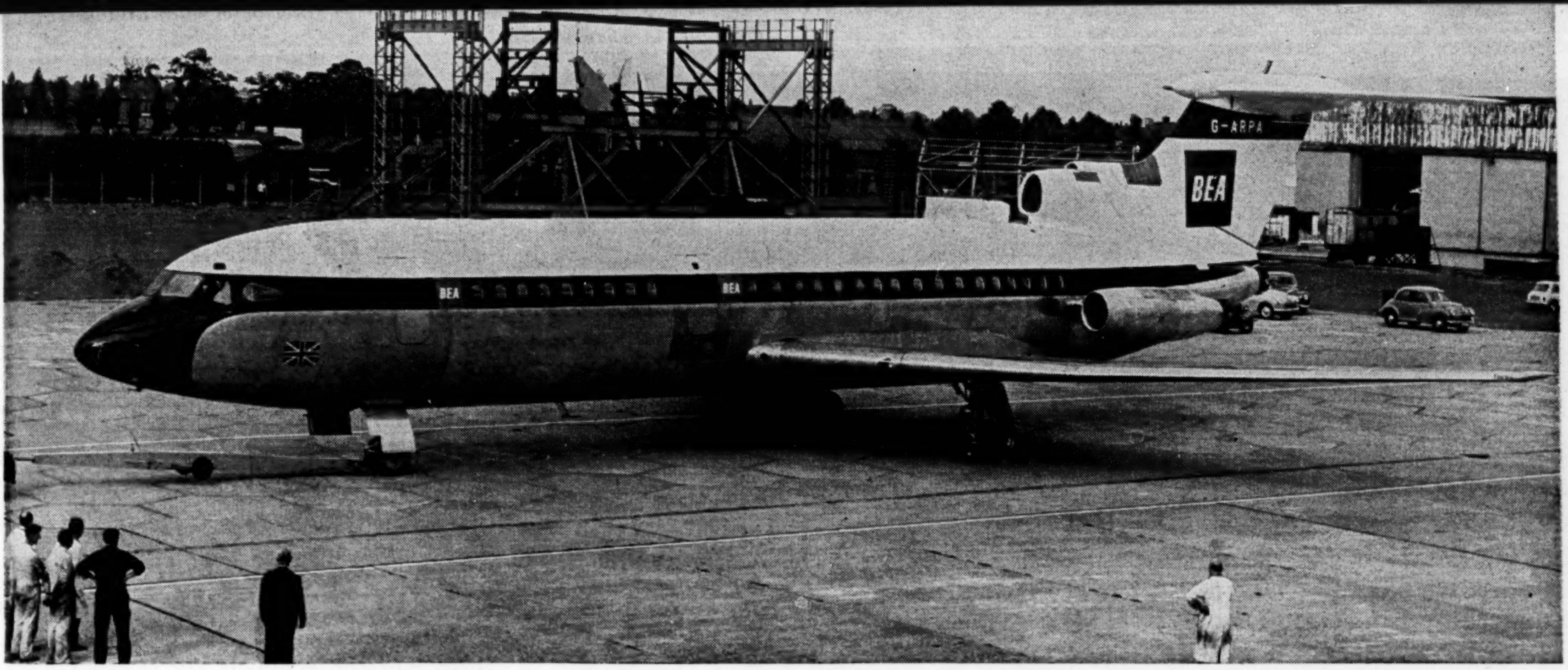


De Havilland Trident Prepared for BEA Delivery

British European Airways has ordered 24 of the three-jet de Havilland Tridents, the first of which rolled out of the company's Hatfield plant recently (AW Aug. 14, p. 43). BEA also has an option on 12 more of the transports, although these would be follow-ons with a larger seating capacity. Powerplants are three aft-mounted Rolls-Royce Spey turbojets generating 9,850-lb. thrust each.

BEA Records New Profit Despite Problems of Phasing-in Vanguards

London—Effects of Vickers Vanguard phasing-in problems on British European Airways' costs have been "enormous" and could be as much as $5 million, according to Anthony H. Milward, chief executive of the airline.

Milward said BEA is still changing Rolls-Royce Tyne engines at the 400-hr. mark and "this should be closer to 1,200 hr." He added that with 10 Vanguards in service "we have more airplanes than engines." But Milward stressed that BEA considers the Vanguard "a fine airplane" plagued by more than the usual break-in problems.

At present, the Vanguard has reached an 800-hr.-a-year utilization. Milward said the fleet will go in "under-utilization" status this winter to allow a number of modifications, described as minor, and including not only work on engines "but on the problems that come with running-in any new airplane."

One modification will be adding weight to the aft section, to eliminate low frequency vibration. At present, Vanguards use 5 deg. of flap on climb-out to soften vibration in this quarter.

Despite Vanguard costs, BEA chalked up a profit for the seventh consecutive year. Profit after taxes was $4,326,898, a drop from the 1959-60 figure of $5,842,018, according to the BEA chairman, Lord Douglas of Kirtleside.

Passenger load factor dropped from 69.4% last year to 66.7%. BEA carried 3,990,957 passengers, an increase from the 3,289,606 passengers carried a year ago. Total freight increased from 36,395 tons to 41,996 tons.

BEA currently is vying with British independent airlines that want to share in the state-owned airline's routes, and the results of Air Transport Licensing Board decisions will have a bearing on BEA's future aircraft commitments, Lord Douglas said.

BEA has ordered 24 de Havilland Trident three-jet short-to-medium-range transports, the first of which has rolled out (AW Aug. 14, p. 43), and Lord Douglas said that this order will not be reduced. However, he pointed out that BEA has an option on 12 more Tridents "which we hope we can justify." Optioned aircraft would be a Trident follow-on with larger seating capacity.

Lord Douglas said that BEA "would be placed in jeopardy" if all the routes applied for were granted to the independents.

Lord Douglas declined to comment on BEA's plans with Sabena to jointly operate Vertol 107s as interim helicopters between London, Brussels and Paris, other than to say "negotiations with the ministry have reached a delicate stage." The airline's annual report noted that "several more years of development work are still necessary before the Rotodyne can be expected to enter into service but BEA believes that this helicopter is still the only one in the world which holds promise of being able to operate commercially self-sufficient scheduled services."

On the immediate financial outlook for BEA, Lord Douglas said results for the first four months of 1961-1962 fiscal year are "causing concern," with BEA, in common with other airlines, finding that traffic is failing to come up to expectations.

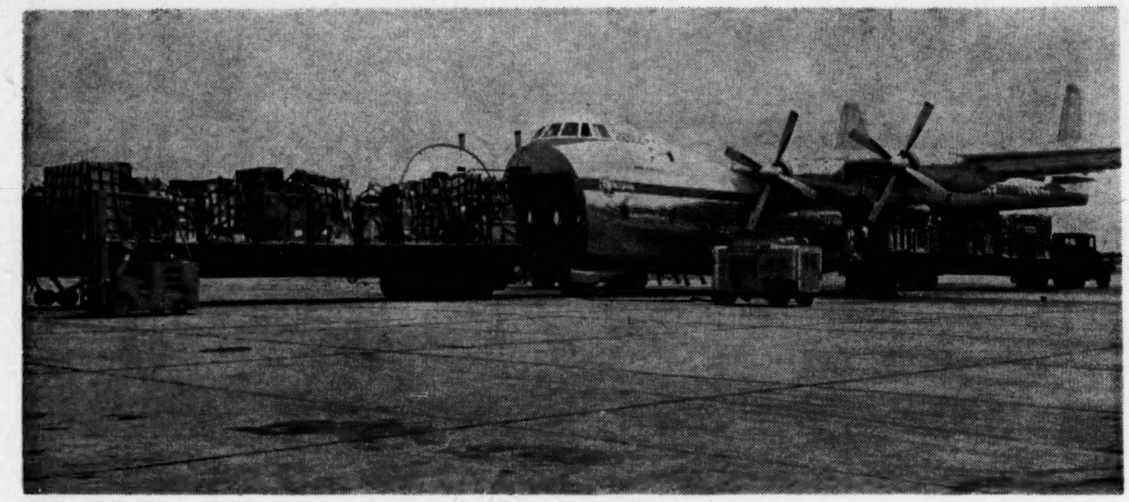
Traffic from the United States to Europe, an important factor in BEA's planning, has scarcely increased and at the same time capacity sold by airlines in Europe has increased by one-fourth and has thus intensified "already fierce competition on international routes served by BEA," according to Lord Douglas.

Lord Douglas said BEA approves of plans for an authority to take over management of London's airports (AW Aug. 14, p. 41) but said costs for technical services should not be recovered from the airlines, but should be borne by the government, as in other countries.

Varig Purchases Real; Approval Is Expected

Varig Airlines of Brazil has purchased Real Airlines, another major Brazilian carrier, to create a system covering some 102,000 mi. Earlier this year, Varig bought 50% of the voting stock of Aerovias Brasilia, the international division of Real.

The latest acquisition, which is subject to approval of the government, gives Varig control of both the international and domestic routes of Real. The government is expected to give its approval of the acquisition since President Janio Quadros previously had urged a pooling arrangement for the services of Real, Varig and Panair do Brasil (AW July 17, p. 41) as a means of curtailing operating expenses.



DOUBLE END loading feature of the Armstrong Whitworth Argosy, operated by Riddle Airlines, is demonstrated at Tinker AFB, Okla. Palletized load has been moved onto special 40-ft.-long truck from the forward door, while another load is ready for rear-door entry.

British Air Freight Rate Reductions Could Boost Traffic, Survey Says

London—Two London economists who have surveyed the European air freight market have concluded that cuts in air freight rates of 40% and 50% would lead to traffic increases of 120% and 200% respectively.

The study was carried out by Dr. Kenneth Sealy and P. C. L. Herdson, of the London School of Economics. Collaborating with them were A. H. Stratford and K. F. R. Brown, of the A. T. S. Co. of Hawker Siddeley Aviation, acting for Sir W. G. Armstrong Whitworth Aircraft (now Whitworth Gloster Aircraft).

The study pointed out that:

- **Although air freight** between Britain and Europe, primarily to France, Germany and Italy, presently is comparatively small, the potential for expansion is considerable. Most important groups are machinery and textiles.
- **In measuring economic advantages** of air cargo, the best yardstick is total distribution costs, rather than freight costs alone. For instance, only 2% of the consignments studied were cheaper by air when assessed on freight charges, but 18% were cheaper when assessed on total costs.
- **Reductions in air freight rates,** while increasing the traffic, could extend the radius of air freight service from the present 250-mi. average to the whole of industrial Europe. Rate reductions in the larger consignments—over 500 kg.—would give shipping agents advantages in consolidation for air freight, comparable with those in surface transport. Rates also should be assessed with some degree of relation to the value of goods being shipped.
- **Basic advantage of air freight** is speed, but static times in total distribution is far too high. Streamlining of customs procedures and the "through-unit" concept of palletized freight would serve to produce substantial improvements.
- **Considerable cargo** lost to the air freight field because it is too large or bulky to fit into the holds of existing freight aircraft. The specialized cargo aircraft, with its higher capacity and lower unit costs, could provide a superior service at higher airline profit margins.

Air freight as yet has not made much of a dent in competition with European surface transport. Air freight as a percentage of rail traffic at present is France, 5%; Belgium, 3%; The Netherlands, 20%; West Germany, 3%; Italy, 5%, and Switzerland, 2%.

Specialized cargo transports in Great Britain include the Argosy 650 line, the Short SC.5 Belfast swing nose, and the ATL-98 Carvair, a Douglas DC-4 conversion.

Airline Officers List Salaries With CAB

Washington—Following is a list of airline officers' salaries, bonuses and indirect compensation, expenses and stockholdings for the year ending Dec. 31, 1960, as filed with the Civil Aeronautics Board:

North Central Airlines—H. N. Carr, president and director, $40,000 salary, 53,882 shares of common stock, $4,054 expenses, $600 bonus and indirect compensation; **F. N. Buttomer,** vice president-traffic and sales, $16,800 salary, 5,333 shares of common stock, $2,933 expenses; **A. E. Schwandt,** vice president-industrial relations, $13,140 salary, 3,715 shares of common stock, $828 expenses; **R. H. Bendio,** vice president-maintenance and engineering, $15,300 salary, 7,500 shares of common stock, $990 expenses; **A. D. Niemeyer,** vice president-operations, $14,580 salary, no stock, $1,001 expenses.

B. Sweet, vice president and secretary-treasurer, $15,720 salary, 5,308 shares of common stock, $691 expenses; **J. P. Dow,** assistant secretary, $7,560 salary, five shares of common stock, $704 expenses; **A. E. Mueller,** chairman of the board, $27,500 salary, 600,692 shares of common stock, 48,289 shares of common stock in the name of others, $9,046 expenses, $600 bonus and indirect compensation; **W. L. Christesen,** accounting consultant and director, $3,600 salary, 5,496.5 shares of common stock, 1,861 shares of common stock in the name of others, $132 expenses, $600 bonus and indirect compensation.

G. F. De Coursin, sales consultant and director, $2,400 salary, 8,887.5 shares of common stock, $617 expenses, $500 bonus and indirect compensation; **K. B. Willett,** director, no salary, 10,074 shares of common stock, $204 expenses, $600 bonus and indirect compensation; **A. L. Wheeler,** vice president-counsel and director, $27,000 salary, 1,050 shares of common stock, $28,875 expenses, $500 bonus and indirect com-director, $2,400 salary, 8,887,5 shares of 1960, 1,155 shares of common stock, $512 expenses; $600 bonus and indirect compensation.

Following firms were paid for services rendered during 1960: **Klau-Van Peterson, Dunlap Advertising,** advertising, $405,410; **Ray & Ray,** statistical information, $17,011; **Alexander Grant & Co.,** audit, $12,800; **H. L. Rutchick,** legal, $8,807; **Immell, Herro, Buehner & DeWitt,** legal, $19,993;

MEA to Shop for Aircraft Replacements

London—Middle East Airlines, currently severing its association with British Overseas Airways Corp., will shop in the world market for future aircraft replacements, according to Sheikh Alamuddin, MEA chairman.

Alamuddin, who described the airline as "no longer a poor relation of BOAC's," stressed that ties with the British aircraft industry would remain strong but MEA now was free to look for the best possible deals.

Since 1955, when MEA joined BOAC, the airline has spent $52 million with the British aircraft industry.

Middle East Airlines started de Havilland Comet service last March and business increased 25% in April, 43% in May and 46% in June. Airline also operates Vickers Viscount turboprops.

The Sheikh predicted eventual formation of a pan-Arab airline to meet what he termed "ferocious competition." The Arab airlines, he said, must get together or die because a pan-Arab airline has become an "economic necessity." He revealed that merger talks are under way in Beirut to merge the four Lebanese airlines into one. Stumbling block previously was foreign ownership, but only Air Liban, in which Air France has an interest, now is involved in this respect.

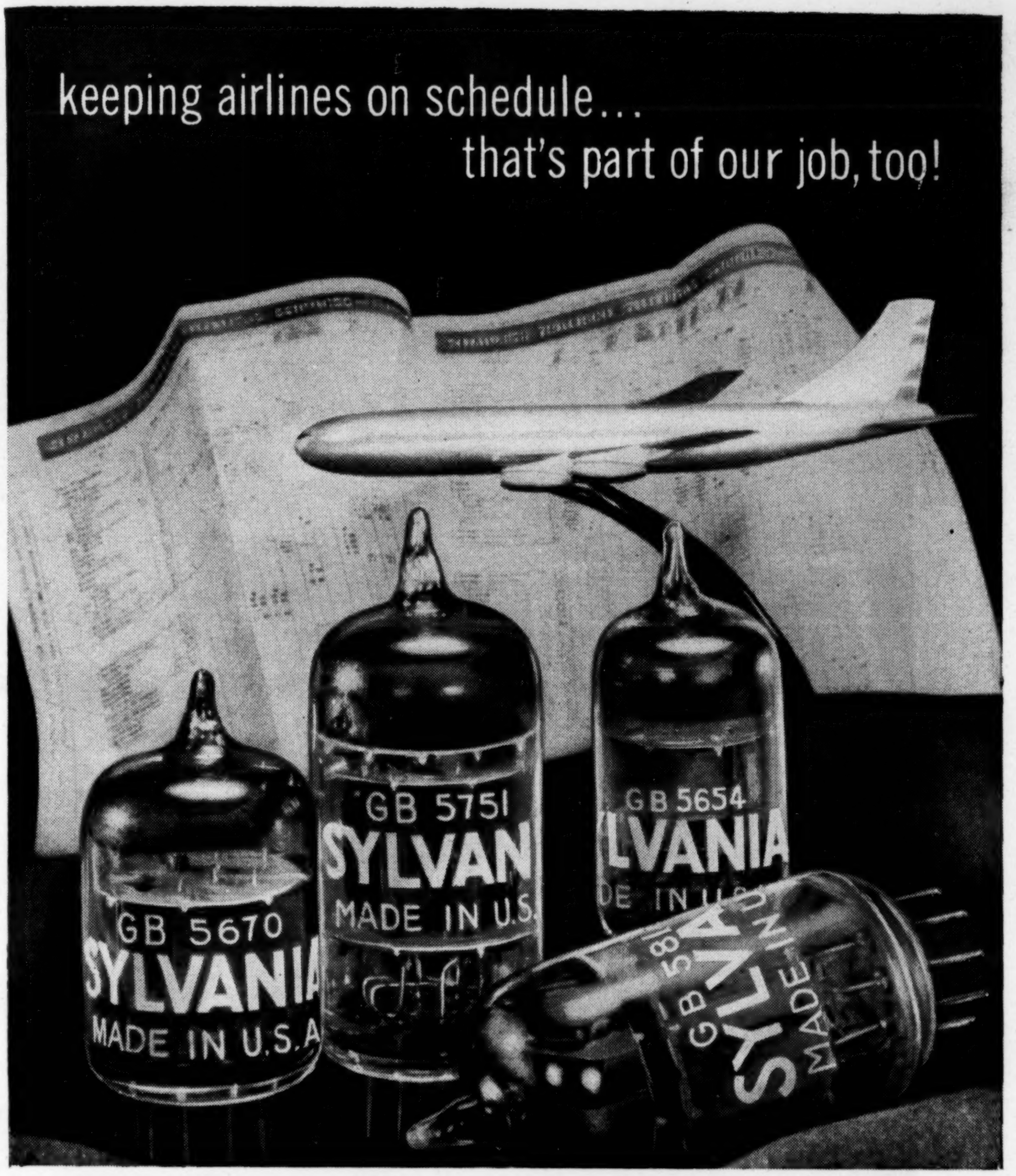
Funds to buy out the BOAC interest in Middle East Airlines (AW Aug. 21, p. 50) were raised in Lebanon, primarily from Intra Bank and from other commercial organizations, the Sheikh noted. Middle East Airlines has consistently shown a profit, except for 1958, when Lebanon underwent a revolution.

Karl Brocken, public relations survey, $13,732; **Aviation Training**, Link training, $5,620.

New York Airways—R. L. Cummings, Jr., president and director, $23,300 salary, 2,250 shares of common stock, $9,883 expenses; **H. Brock**, vice president (resigned April, 1960) and director, $3,629 salary, 1,250 shares of common stock, $153 expenses, $3,906 bonus and indirect compensation; **J. E. Gallagher**, vice president, $16,849 salary, 500 shares of common stock, $4,595 expenses; **W. W. Hogan**, vice president and treasurer, $13,556 salary, 500 shares of common stock, $1,698 expenses; **G. B. Eastburn**, vice president, assistant to the president and assistant treasurer, $11,000 salary, 100 shares of common stock, $32 expenses; **R. Wheatland, II**, vice president (since Dec. 5, 1960), $10,000 salary, 500 shares of common stock, $1,753 expenses; **J. H. Slate**, secretary, (salary included in remuneration paid the firm, **Skadden, Arps, Slate, Meagher & Flom** listed below, no stock); **L. G. Carter**, assistant vice president-operations, $18,043 salary, 100 shares of common stock, $321 expenses; **R. De Haan**, assistant vice president-maintenance, $12,000 salary, 500 shares of common stock, $259 expenses; **G. J. Glynn**, assistant treasurer, $8,289 salary, no stock, $180 expenses; **F. Peters**, assistant secretary, $5,243 salary, no stock, $56 expenses; **H. Ammidon**, director, $500 salary, no stock; **R. E. Blum**, director, $600 salary, no stock, 3,000 shares of common stock in the name of others; **R. W. Dowling**, director, $200 salary, no stock; **F. M. Glass**, director, $700 salary, 200 shares of common stock; **G. Loening**, director, $600 salary, 8,500 shares of common stock; **R. G. Goelet**, director, $600 salary, 5,000 shares of common stock; **S. C. Park**, director, $700 salary, no stock; **W. Shields, Jr.**, director, $800 salary, 200 shares of common stock.

Following firms were paid for services rendered during 1960: **Selig Altschul**, aviation and financial consultant, $6,103; **George Daly Associates**, public relations, $13,759 (for services December, 1959 through December, 1960); **Information Center**, graphic arts, $13,818; **Lybrand, Ross Bros. & Montgomery**, accounting, $19,142 (for all year 1959 and partial year 1960); **Skadden, Arps, Slate, Meagher & Flom**, legal, $115,779 (for partial year 1959 and January through September 1960).

Alaska Airlines—C. F. Willis, Jr., president and director, $39,999 salary, 42,300 shares of common stock, $11,125 expenses, $200 bonus and indirect compensation; **J. F. Clark**, director, $8,637 salary, 1,000 shares of common stock, $7,453 expenses, $200 bonus and indirect compensation; **R. W. Gilbert**, executive vice president, secretary and director, $22,000 salary, 500 shares of common stock, $4,473 expenses, $200 bonus and indirect compensation; **D. M. Kendall**, director, no salary, 10 shares of common stock, $200 bonus and indirect compensation; **J. G. Larson**, director, no salary, 20 shares of common stock, $150 bonus and indirect compensation; **E. J. Rusing**, director, no salary, 1,000 shares of common stock, $200 bonus and indirect compensation; **J. P. Walker, Jr.**, director, no salary, 31,405 shares of common stock held in the name of others, $200 bonus and indirect compensation; **R. Maass**, director, (since Feb. 18, 1960), no salary, 100 shares of common stock, $150 bonus and indirect compensation; **H. M. Margolis**, director, no salary, 2,700 shares of common stock, $150 bonus and indirect compensation; **G. Kinnear**, director, (until Sept. 30, 1960), no salary, 1,000 shares of common stock, $100 bonus and indirect compensation; **R. B. Atwood**, director (from Sept. 30, 1960), no salary, 1,100 shares of common stock; **M. E. Sharp**, vice president, and assistant secretary (from Sept. 30, 1960), $12,500 salary, five shares of common stock, $1,524 expenses; **L. E. Peterson**, vice president-services, $12,250 salary, 500 shares of common stock, $3,732 expenses; **R. H. Herrnstein**, treasurer, and comptroller, $10,916 salary, 500 shares of common stock, $476 expenses; **D. L. Ingalls**, assistant treasurer and secretary, $11,083 salary, five shares of common stock, $4,979 expenses.



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AIRLINE OBSERVER

▶ Domestic trunkline coach traffic continued to swing upward during July as the dominant class of business handled by the airlines and, with the introduction of new excursion rates (AW July 24, p. 40), the gap between first-class and coach traffic is expected to grow even wider. In July, coach traffic accounted for 62.9% of all traffic handled by the 11 trunk carriers compared with 54.4% in July, 1960. For the first seven months of 1961, 55.2% of all traffic was coach, compared with 47.4% in the same period of 1960.

▶ Federal Aviation Agency is weighing whether to install at least one General Precision/Librascope computer in an operational traffic control center if a decision should be reached to halt work on the Data Processing Central (DPC) system (AW Aug. 7, p. 41). The Librascope computers bought by FAA were to form the heart of the initial DPC semi-automatic traffic control system, the first of which was to be commissioned in Boston next year, and of subsequent systems. But the computer also can be programed for routine bookkeeping chores if necessary, to recoup some of the agency's investment.

▶ With recent reduction of duty-free allowance from $500 to $100, U. S. customs procedures—already bogged down by tedious baggage inspections—are expected to become even more time-consuming for incoming passengers at major U. S. airport gateways. New exemption, which applies to goods purchased on trips of at least 48 hr. duration, can be claimed no more than once every 30 days.

▶ Aeroflot chief Yevgeni Loginov claims that the Soviet carrier is now at least on a par with "foreign capitalist companies" from the standpoint of flight regularity and passenger comfort aloft. Speaking from recently acquired first-hand experience, Loginov was quoted in the Soviet press as criticizing the Sud Caravelle, the Douglas DC-8 and DC-7 for having "little or no space to hang one's coat or put away one's hat. Seating on economy class flights is extremely crowded." The Aeroflot chief also asserted that in-flight meal service on "Capitalist" lines is "not qualitatively superior to ours."

▶ First Vickers VC.10 fuselage has started pressure tests at full 9-lb. differential. With the exception of nose radome, landing gear bays, wing cutout and tail cone, entire fuselage is pressurized to 9 lb. Meanwhile, Vickers-Armstrongs has abandoned attempts to find a name for the VC.10 bypass transport. Baron was considered as a likely follow-on to Viscount but Beech Aircraft has taken that name so the Vickers plane will continue to be known by its letter-number designation.

▶ Chances that Japan will win its long-sought Moscow traffic rights for Japan Air Lines under a reciprocal bilateral air transport agreement are still slim but the Russians are expected to offer a compromise plan which could be a first step toward commercial air service between the two countries. It is now considered possible that the Russians will offer the Japanese a route between Tokyo and Irkutsk via Khabarovsk instead of only as far as Khabarovsk, as originally proposed. It is also possible that Aeroflot will be willing to terminate its flights at Chitose and Hokkaido instead of Tokyo, as originally desired by Moscow.

▶ Airline common stocks, reacting to a heavy industry loss in the first-half of 1961, fell sharply last week in a market that was generally strong. During the early half of last week, listings of individual carriers fell as much as 2.5 points in active trading.

▶ Crash of a Hungarian Douglas DC-3, operating on a charter excursion, in Budapest last month has been attributed to a "grave lack of discipline by members of the crew . . ." An investigation found that the crew had made "over-abrupt" turns and "over Budapest forest . . . had deviated from the prescribed route, flown in irregular waves, reduced altitude below the prescribed height." Thirty persons were killed in the accident.

▶ Federal Aviation Agency last week certificated the General Electric CT58-110-1 commercial turboshaft engine which will power the Boeing-Vertol 107 and Sikorsky S-61 helicopters.

SHORTLINES

▶ **British Overseas Airways Corp.** will increase flights on Caribbean routes, beginning in October and reaching a peak in mid-December. The airline will operate daily nonstop Boeing 707 flights between New York and Nassau, and New York and Kingston and Montego Bay, Jamaica.

▶ **Eastern Air Lines** has received the first of 15 Boeing 720 jet transports scheduled to be delivered before winter. The aircraft will go into service Sept. 24 with one round trip daily between New York, Jacksonville and Miami.

▶ **Lake Central Airlines** reports a quarterly dividend of 32.5 cents per share on its 6.5% preferred stock.

▶ **Los Angeles International Airport** reports 3.2 million domestic and international passengers passed through the terminal during the first six months of this year. Last year's figure for the same period was 3 million.

▶ **Pacific Air Lines** has reported a net profit of $119,000 for the first half of 1961, compared with a net loss of $229,000 for the same period last year. The airline credits the profit to new operating and scheduling flexibility under the Civil Aeronautics Board class subsidy rate. The airline cut operating costs $800,000 during the six-month period.

▶ **Panagra** reports a 13% traffic increase for the first seven months of 1961 over the same period last year. Revenue passenger miles totaled 124.6 million for the period.

▶ **Qantas Empire Airways** has begun conversion of its seven Boeing 707s to turbofan power at American Airlines' Tulsa maintenance base. Conversion of the 29 Pratt & Whitney JT3C-6 turbofan engines will be completed within four months.

▶ **Trans World Airlines** has asked Civil Aeronautics Board to approve a new route between Chicago and Cleveland and unrestricted operating rights between Cleveland and New York. Cleveland-New York flights now must originate or terminate at or west of St. Louis.

▶ **Trans World Airlines** reported 100% load factors in the coach section on the first two jet flights leaving New York for Los Angeles and San Francisco under the new $198 round-trip transcontinental jet excursion fare plan (AW July 24, p. 40).

A look at what's ahead in the realities of space exploration

Some predictions from Douglas —builders of Thor which has launched 80% of all successful U.S. satellites & space probes in the past two years

Our mastery of space has advanced so rapidly that only diehard pessimists doubt the moon and planets will know our footsteps within a few decades.

Already a vehicle capable of orbiting a 19,000-pound payload, or driving 5,000 pounds to escape velocity, or lofting 2,500 pounds to Mars or Venus is being built in the U.S. This is Saturn, taller than a 14-story building, with an initial thrust of 1.5 million pounds. Its second stage, under construction for NASA by Douglas, will use a cluster of liquid hydrogen-oxygen engines of unique design.

The world knows a man can rocket into space and return. Can he survive for long periods? Douglas studies give a strong affirmative. Zero gravity and artificial G require further study. Radiation is a continuing problem, but reports from Discoverer XVII, one of 46 space projects launched by the Douglas Thor rocket, show the threat less serious than was first thought.

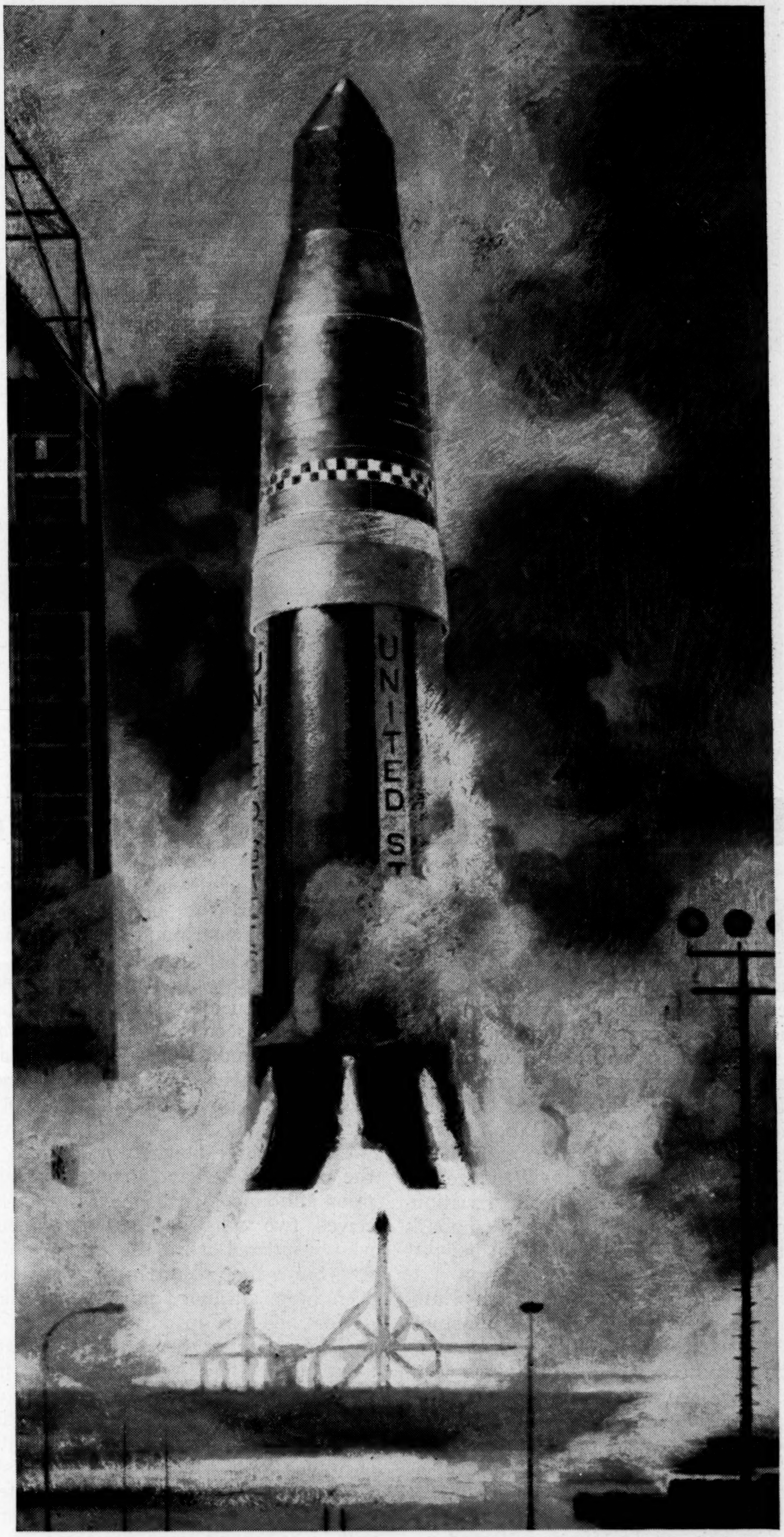
The cost of space travel? A breakthrough in nuclear power, which Douglas engineers confidently predict, should cut the operational cost of a trip to the moon to about $900 per passenger. Other power sources, already under study, may even open such stars as Sirius and Alpha Centauri to travel.

The DC-8 Jetliner, an example of Douglas aero-space leadership

Few of us will ever be lunar commuters, but growing millions are learning about a new kind of travel through the DC-8 jet.

Here is an airplane that slices through time at 10 miles a minute, opens the world to all who have an urge to get up and go places.

Next trip, fly a DC-8 jet, newest of which is the DC-8 Series 50, fastest long-range jetliner in the sky.



Douglas is building Saturn's 2nd stage.

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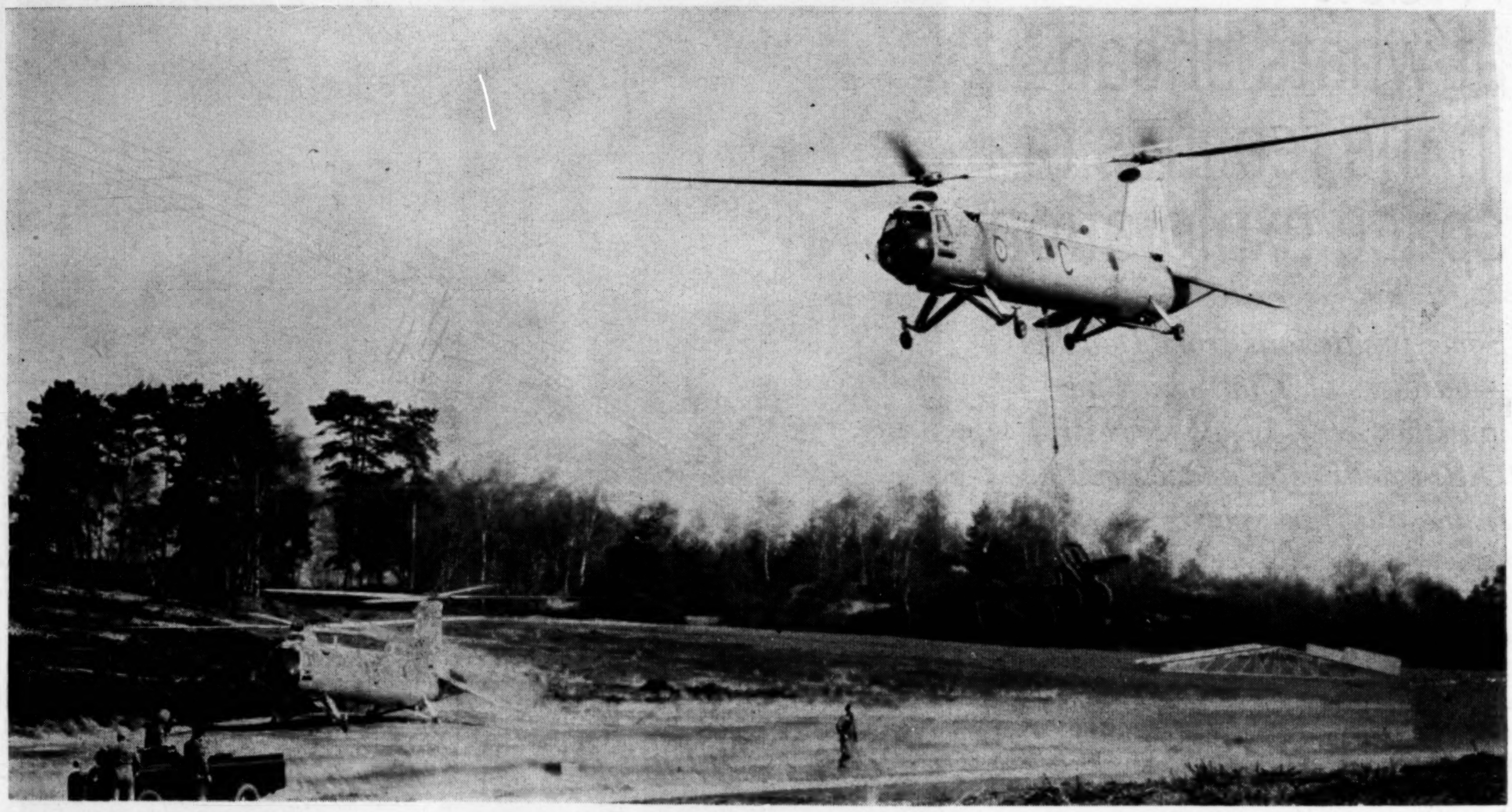


WESTLAND BELVEDERE, powered by two Napier Gazelle N.Ga. 2 free turbines of 1,650 shp. each, could be revised for commercial uses.

British Study Increased Helicopter Use

By Herbert J. Coleman

London—Expanded use of rotary-wing aircraft in Great Britain has been given new impetus in a series of developments led by recommendations for construction of a city-center heliport here.

In past years, with exception of military use, the helicopter in the United Kingdom has been relegated to a subsidiary role in air transportation despite surges in the use of fixed-wing methods. Signs that this situation will change are:

- **Report** of a Ministry of Aviation-sponsored committee, placing emphasis on three possible international heliport sites along the Thames River.
- **Negotiations** between British European Airways and Sabena for joint purchase of five Vertol 107 helicopters to start city-center service between London, Brussels and Paris.
- **Formation of a new authority** to run London's international airports and the Thames heliport, when it eventually is constructed.
- **Considerable progress** on silencing the tip-jet noise of the Westland Rotodyne, BEA's choice for city-center service when, and if, a production order is approved by the Ministry of Aviation and the Exchequer.

The trend is encouraging, particularly in view of support by Minister of Aviation Peter Thorneycroft who, in a discussion of a White Paper on Civil Aerodromes, contended that heliports are a necessity for "modern cities that want modern transportation." But there are a few holes in the dike:

- **Noise problem** of the Westland Rotodyne has been blown out of proportion by excessive secrecy on progress toward substantial reduction. The holdback comes from the Ministry of Aviation despite an encouraging Ministry experiment not long ago, when a Rotodyne was deliberately flown over London to the present Westland heliport without prior announcement. The Ministry received two calls—both from residents who wondered what the big machine was. Since then Westland has explored even more advanced noise suppression devices and has an advanced design of the aircraft under way, but will say little about either. The company has submitted to the Exchequer a tender on building 12 Rotodynes for the British armed forces, in addition to BEA's letter of intent, and there the matter rests.
- **Report of the planning committee,** while encouraging, left the Ministry with recommendations for three sites, instead of one, after two years of study, thus in effect delaying a firm decision pending a re-evaluation of the three. Report on construction of a 600-ft.-high heliport was included with a notation that planning objections would be "very great or insuperable."

One method, which so far has received no official consideration, is mooring a surplus carrier in the Thames to provide a ready-made heliport. But the main problem here is the series of low bridges, which may be insurmountable even by stripping superstructure and ballasting the vessel to the limits.

Decision on construction of the heliport is, of course, crucial to BEA in its Continental route planning. The existing Westland heliport is too small for large-scale operations, and is located near Battersea Park with resultant congested traffic leading to London's West End and city district. Most desirable area is much nearer the London and Westminster Bridges.

No London Service

There is at present no scheduled helicopter service between the two international airports—London Heathrow (the main intercontinental airport) and London Gatwick (connecting the Continent), although operators have made, in the past, searching studies of scheduled operations at New York, Chicago and Los Angeles. Equipment is a major consideration, calling for twin-turbine aircraft to fulfill congested area safety requirements, and the resultant dollar expenditures.

One major operator, British United Airways, runs a helicopter division with resounding success, but mostly in foreign countries. Alan Bristow, executive managing director, who, with Fison-Airwork, merged his firm with British United a year ago, is interested in scheduled services, both airport-city and city-Continent, but at the moment is inclined to think the Vertol 107's passenger capacity (18-25 on short hauls) too small. He feels that this capacity would be cut to 15 for London-Brussels services and the costs would far outweigh the load factors.

(British European Airways has said that, although fares have not been worked out, the London-Brussels price would be comparable with present fixed-wing first-class fares, "and possibly a bit higher.")

Bristow, a helicopter pilot who on occasion flies his own charters, is emphatic about the solution to successful Continental service: "You need a gimmick. And the gimmick is high-density seating, no frills and low fares. City-center convenience is a start, but it's just not enough."

Bristow is keeping a close eye on Rotodyne developments and considers this the machine for his company, if it ever jumps into the scheduled routes across the Channel. There are no letters of intent.

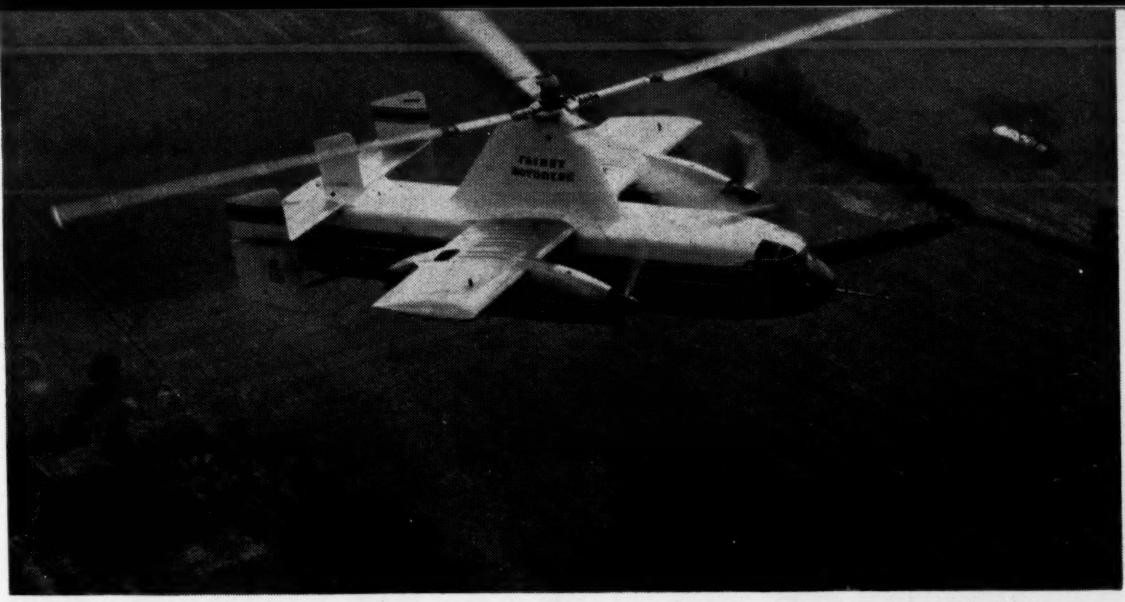
Varied Operations

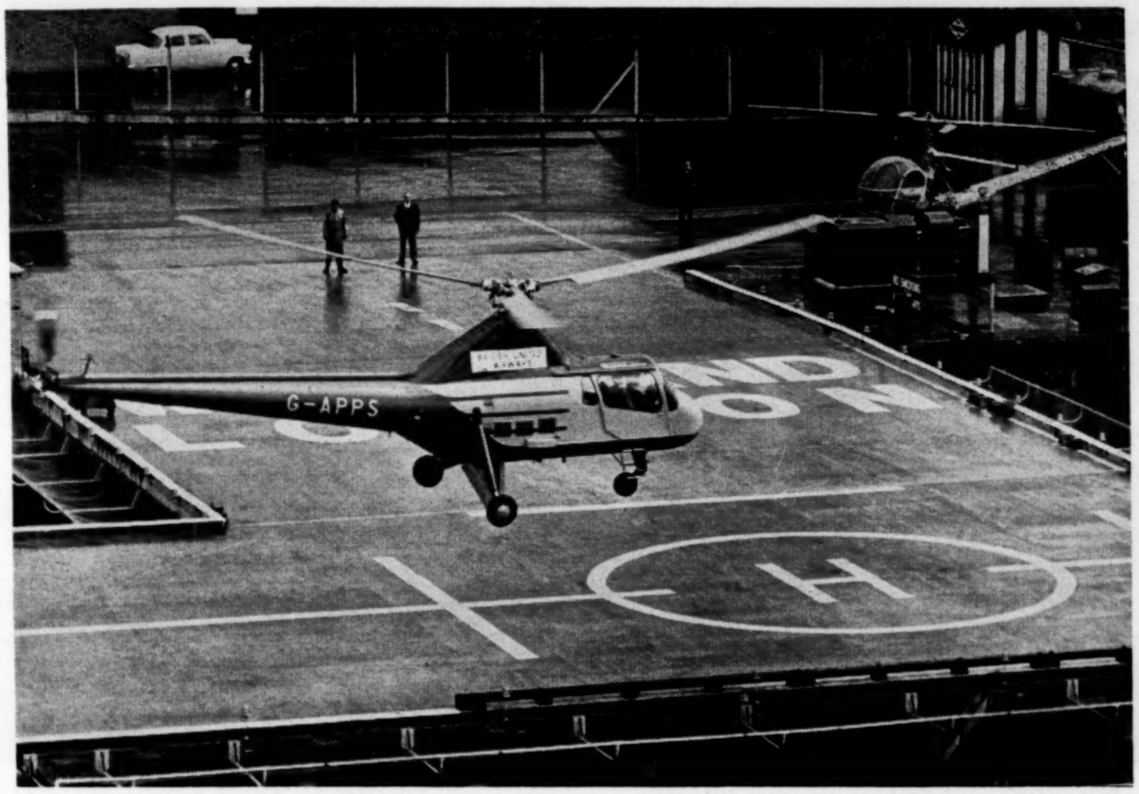
British United's helicopter operations in the United Kingdom are modest and concentrate on charter and agricultural but they took a new turn with completion of an agreement with Royal Navy to train helicopter pilots at the Redhill Airport center. Program will start in September with Royal Navy providing the air and ground curriculum and British United the pilots, equipment and classroom facilities, under direction of Alan Green, operations manager.

Green already has a complicated job, watching over helicopter operations ranging from Brazil to Kuwait and the Persian Gulf. Primary customers are oil companies, although the Kuwait government has aircraft and crews on lease to support Army operations. On the surface, this should have posed diplomatic problems during the British Kuwait operation, but it didn't. Green said nobody paid much attention to the so-called fighting, but just flew the daily missions as routine.

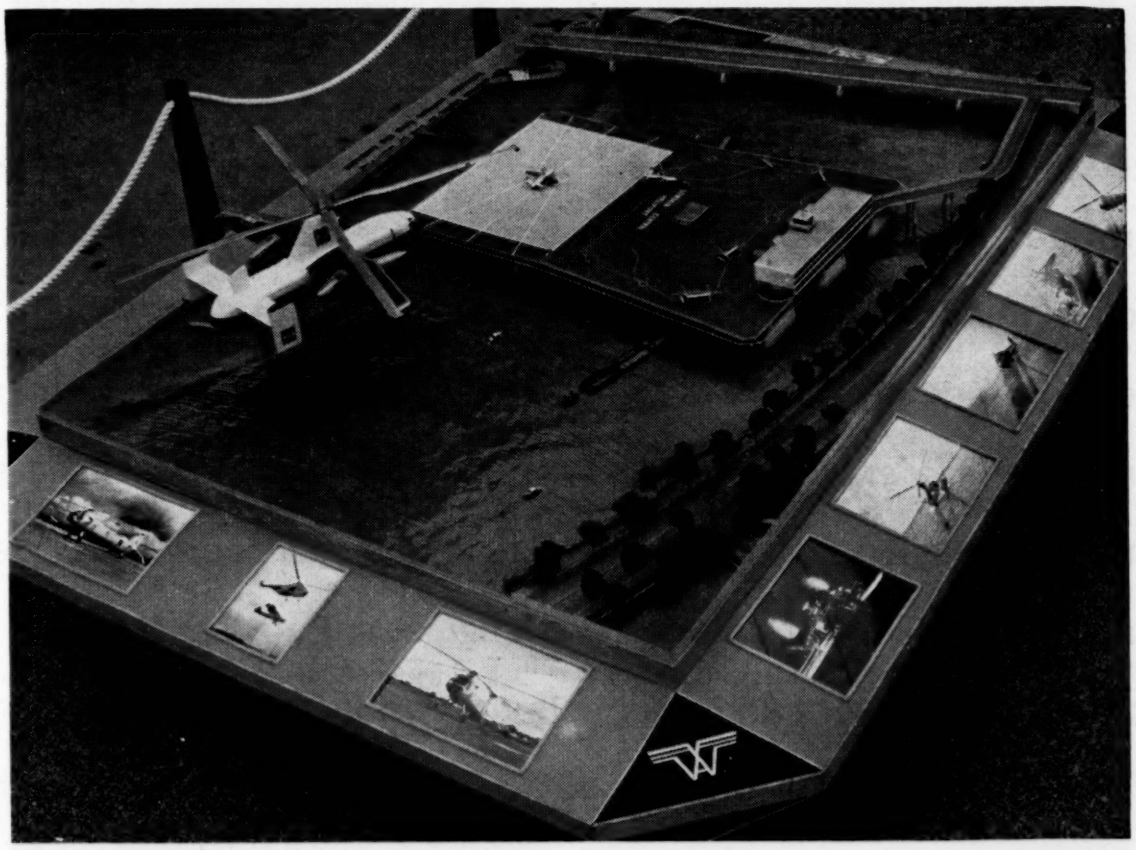
Another highly successful operation is at Das Island, far out in the Persian Gulf, a tiny strip used as a base to service off-shore drilling rigs. Another operation, headquartered in Bermuda, runs contract work in the Caribbean and Bolivia.

The company has six Hiller 12Es on order; the fleet now includes 15 Whirlwinds, 23 Hillers, 7 Bell 47s and 4 Widgeons. Its most recent acquisition is purchase of the helicopter


ROTODYNE PROTOTYPE, shown on one of its test flights, is powered by Eland engines. Follow-on version would have Tyne engines and new sound suppression devices.



BRITISH UNITED AIRWAYS Widgeon lands at the Westland heliport in Battersea. Heliport is considered temporary and is used mainly for charter pickups and delivery.


POSSIBLE RIVER HELIPORT, designed for use of the Westland Rotodyne, is a conception of the manufacturer for connection with a special overpass.

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Proposed London Heliport Sites

Comparison of travel times and noise features of the three proposed heliports; time is based on journey by automobile

SITE	SIZE (ACRES)		PLATFORM HEIGHT above ground	USABILITY of approaches over river or industrial areas	NOISE FEATURES		ROAD TRAVEL TIME (MINUTES)		PUBLIC TRANSPORT
	Platform	Floor area below platform			Development within ¼ mile	"Clear" distance along flight sectors	Grosvenor Square	Mansion House	
NINE ELMS(B)	13 (Pads + up to 9 working stands)	16	50 ft.	99%	Population:— 2,500 residents Sensitive buildings 4 proposed schools	Takeoffs 2,000-3,000 ft. Landings:— 2,500-3,000 ft.	15-19	17-19	No underground station close to the site, but the Victoria Tube Extension might be pushed southwards to provide a station at Vauxhall.
CANNON STREET STATION	(i) 5½ (Pads + 4 working stands)	9	54 ft.	98%	Population:—330 residents:—45,000 office workers Sensitive buildings Mansion House Southwark Cathedral	Take-offs:— 4,000 ft. Landings:— 4,000 ft.	23-27	1-2	Cannon Street Underground Station and frequent buses along Cannon Street
	(ii) 7 (Pads + 7 working stands)	12							
ST. KATHERINE DOCKS	8¾ (Pads + 9 working stands)	21	48 ft.	98%	Population:— 400 residents Sensitive buildings: The Tower, The Royal Mint and a school	Take-offs:— 1,000-4,000 ft. Landings 4,000 ft.	28-34	10-13	Tower Hill Underground Station 10 minutes walk away

unit of Christian Salvesen & Co., Ltd., a shipping and whaling company which owned three Whirlwinds.

BEA has been operating its Helicopter Experimental Unit since 1947 and currently has a Bell 47B3, a Bristol 107, two Westland-Sikorsky S-55s and an Agusta-Bell 47G, all based at Gatwick for charter and agricultural work. BEA was a pioneer in carrying mail in the United Kingdom for the General Post Office and has conducted a number of all-weather test programs for the Ministry of Aviation at the Royal Aircraft Establishment, Farnborough.

Another helicopter development is exploration of the value of the Bensen Gyrocopter as an agricultural spraying aircraft, undertaken by D. Napier & Son, Ltd., and Pan Britannica Industries, Ltd., at Luton Airport. Aimed at small acreage farming, the program was interrupted when the Gyrocopter crashed, apparently due to ground effect, injuring the pilot. Machine was repairable and the pilot was not seriously hurt so the program is once again in progress.

Use of the Bensen machine, the companies contend, gives these advantages:

- **High maneuverability** over a wide range of speeds, particularly in the low-speed regime on irregular-shaped fields.
- **All-around vision**, because the pilot sits in the open.
- **Ease of transport**, since the unit is self-contained with a vehicle and trailer for towing and servicing, and simplicity of maintenance.

Pan Britannica Industries was formed in 1958 to provide crop-spraying on a national basis, using fixed wing aircraft operating from Waltham Abbey, Essex. It has joined Napier in this venture on a common-knowledge basis, jointly funded, although Napier owns the Bensen and calls it a Gyroplane.

Another move in the helicopter field is establishment of an Umbaugh 18 dealership by Holman & Co (Engineers) Ltd., Glasgow, Scotland, which says it shortly is expecting delivery of a demonstrator. It is advertising the Umbaugh for sale at $11,743 FOB United States, duty paid.

Only Manufacturer

Britain's only helicopter manufacturer is Westland Aircraft, Ltd., which builds the Scout, Whirlwind, Wessex, and the twin-engine Belvedere, all military aircraft, and has been flying the Rotodyne prototype for some time, powered by Eland engines. A Tyne-powered version, carrying 68-70 passengers, is in the design stage. It also is preparing the SRN. 2 Hovercraft, a 27-ton vehicle capable of speeds up to 70 kt. while carrying 66 passengers for its initial flight next spring.

The Hovercraft is a concept still not explored to its fullest, to the chagrin of its inventor, C. S. Cockerell, who said there are only about 80 engineers and technicians now working on the designs. He thinks up to $28 million a year should be spent on development for the next 20 years to realize the full benefits.

This means of transport was not considered by the Committee on Planning of Helicopter Stations in the London area. Primarily, this group is interested in a raised platform, near the Thames, but said it made no attempt to assess precisely the cost "since this is a matter for the promoters . . . but the capital cost is likely to run into several millions."

Present Westland heliport was considered too small, although the committee noted that in its first year the heliport recorded 2,000 movements with peaks of 30 in one day. A committee project of 10 scheduled operations could, by 1970, produce 900,000 passengers a year, rising to 1.5 million passengers by 1975 with 15 scheduled services.

Minimum operational area needed for a city-center heliport will be about four acres for five movements an hour, or about eight acres for 25 movements per hour. Single heliport of 12 acres should be capable of handling traffic into the 1970s.

Three sites referred to by the committee are:

- **Nine Elms goods yard**, which would have a 13-acre platform over part of

CALLERY PROPELLANT BRIEFS

Let's talk impulse in space

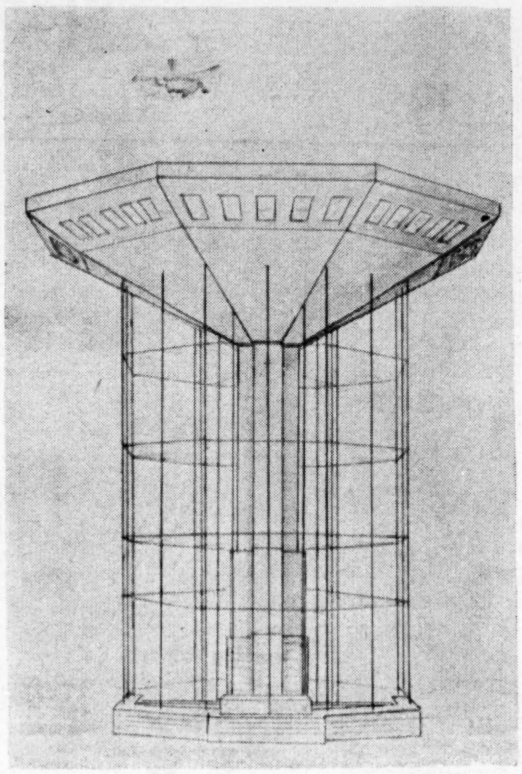
Exotic chemical propellants will often find their most useful applications in upper stages, for course or orbit correction and lunar landing or take-off. Isp values compared at $P_E = 0.2$ psia have a different relationship than when compared at $P_E = 14.7$ psia. Such an approximation of "space" conditions gives a much truer picture of the relative performance of propellant systems. We present (from Callery's new booklet — Propellant Performance Data*) a few excerpts to illustrate the point. As the U. S. standardizes on LOX-RP, LOX-LH₂, and solids, there is still considerable merit in storable liquid systems for specialized jobs in space.

PROPELLANT SYSTEM	SPECIFIC IMPULSE	
	Sea Level 1000→14.7	Space 1000→0.2
H_2–O_2	391	470
B_5H_9–OF_2	367	466
B_5H_9–F_2	360	460
N_2H_4–F_2	363	436
B_5H_9–O_2	327	421
B_5H_9–NF_3	326	412
B_5H_9–H_2O_2	316	405
B_5H_9–N_2O_4	306	391
B_5H_9–ClO_3F	306	390
RP–O_2	300	379
B_5H_9–ClF_3	290	368
N_2H_4–N_2O_4	291	354
CH_2–NO_2ClO_4	278	349

*Available upon letterhead request from:

Callery Chemical Company, Defense Products Department

Headquarters: Callery, Pennsylvania. Telephone Evans City (Pa.) 3510
West Coast: 15537 Lanark Street, Van Nuys, California, Telephone STate 1-5761
Washington, D.C.: 709 DuPont Circle Building, Telephone ADams 4-4200
Dayton, Ohio, Suite 12, 2600 Far Hills Avenue, Telephone AXminster 8-1242



ARTIST'S CONCEPTION is of 600-ft. high heliport, made of concrete. Elevators would carry passengers up the central column to the heliport pad.

the existing goods depot on the south side of the Thames, upstream from the Vauxhaul Bridge. Site has a wide range of unobstructed approach and takeoff sectors.

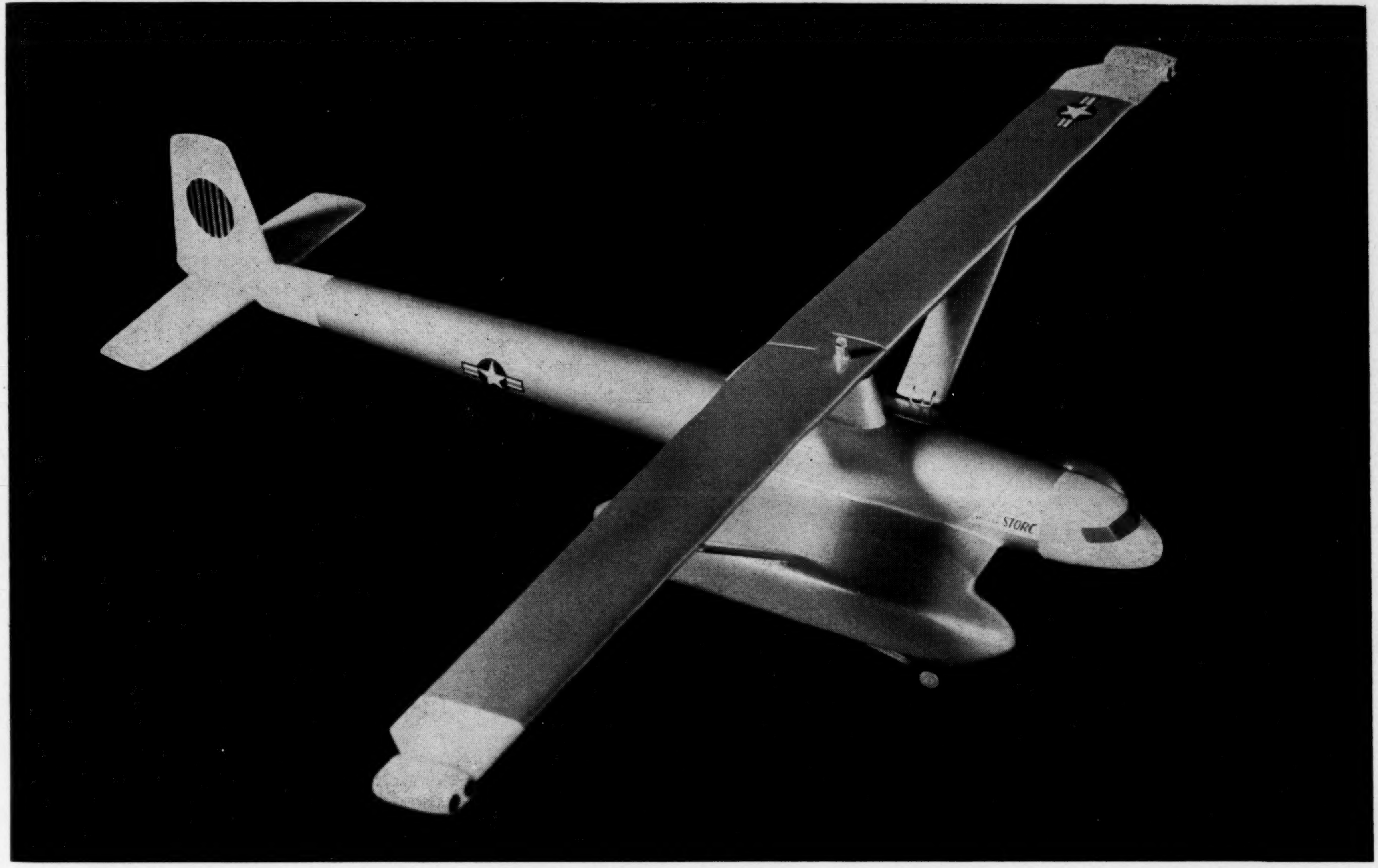
- **Cannon Street station,** built on the station rooftop on a three-acre site, with a platform extending the area to 5½ acres.
- **St. Katherine's Dock,** near Tower Bridge, would require a 54-ft. high platform to avoid cranes and other obstructions but would have a high standard of usability for both single- and multi-engine helicopters.

Site Evaluations

Committee said Nine Elms and Cannon Street are "reasonably well placed" to serve the West End and the city, but St. Katherine's Docks is "too far" from the West End to be convenient for the majority of passengers.

Referring to the high tower type of heliport, the committee noted that such a structure (costing about $16 million) would ruin the skyline and would conflict with city office planning requirements and would take four years to build. Not mentioned specifically, but a valid objection by operators, would be flights during low ceilings, often much lower than 600 ft., which plague central London during winter months and also just plain London fog.

Committee was appointed in 1959 and was chairmanned by G. I. Morris. Members included representatives of British European Airways, London County Council, British Transport Commission and the Ministry of Aviation.



STORC (Self-Ferrying Transocean Rotary Wing Crane), would be convertible on the ground to a fixed-wing configuration.

Large Crane Combines Fixed, Rotary Wing

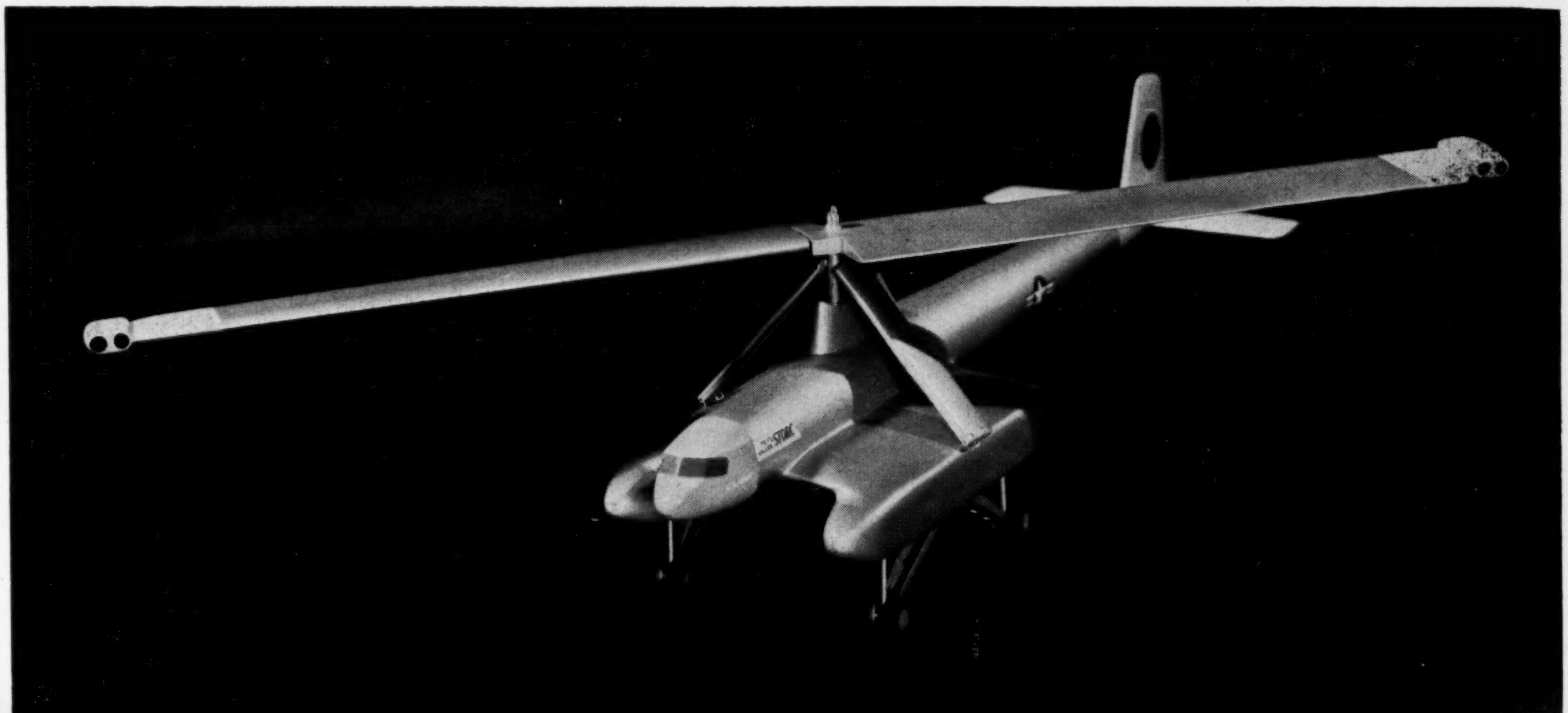
By Russell Hawkes

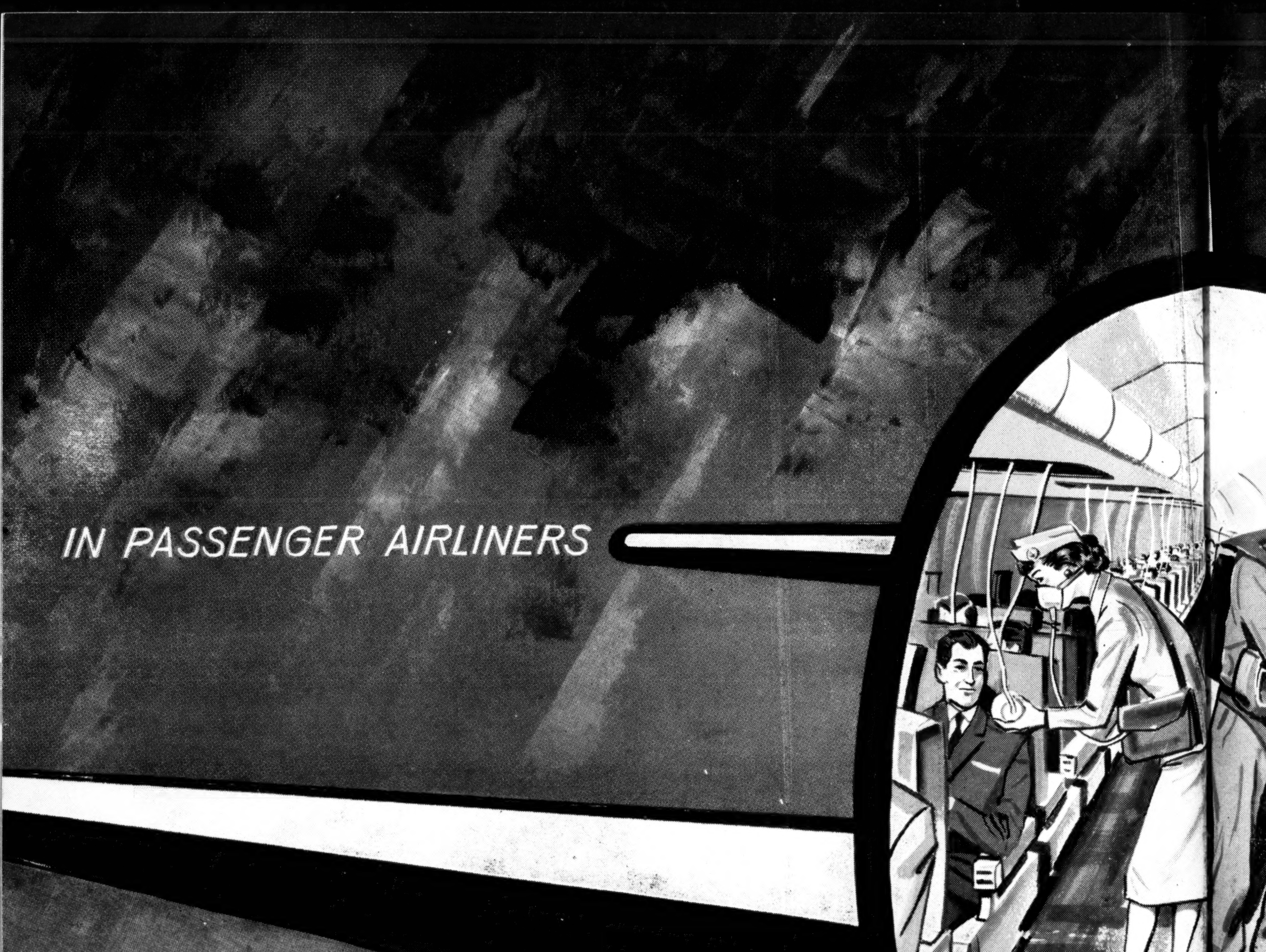
Large flying crane helicopter which can be converted on the ground to a fixed-wing configuration for transocean range ferry flights has been proposed to Defense Department by Hiller Aircraft Corp.

Hiller calls the proposed dual category aircraft the Storc (Self-Ferrying Transocean Rotary Wing Crane) and designates it Model 1098. Company officials argue that the need for a flying crane in front line areas has not been met in the past because of the difficulty of transporting them overseas quickly and economically. Helicopters have not had enough range to be ferried across the ocean because of their aerodynamic inefficiency. Lift-drag ratios of helicopters are about a quarter of those for fixed-wing aircraft. The Storc concept would correct this by turning one rotor blade over and locking the rotor in position to serve as a fixed wing. Conversion in flight is not part of the idea.

Hiller officials believe the exhibition

HILLER'S crane would be operated by tip-mounted turbojet engines for both rotary and fixed-wing operations.





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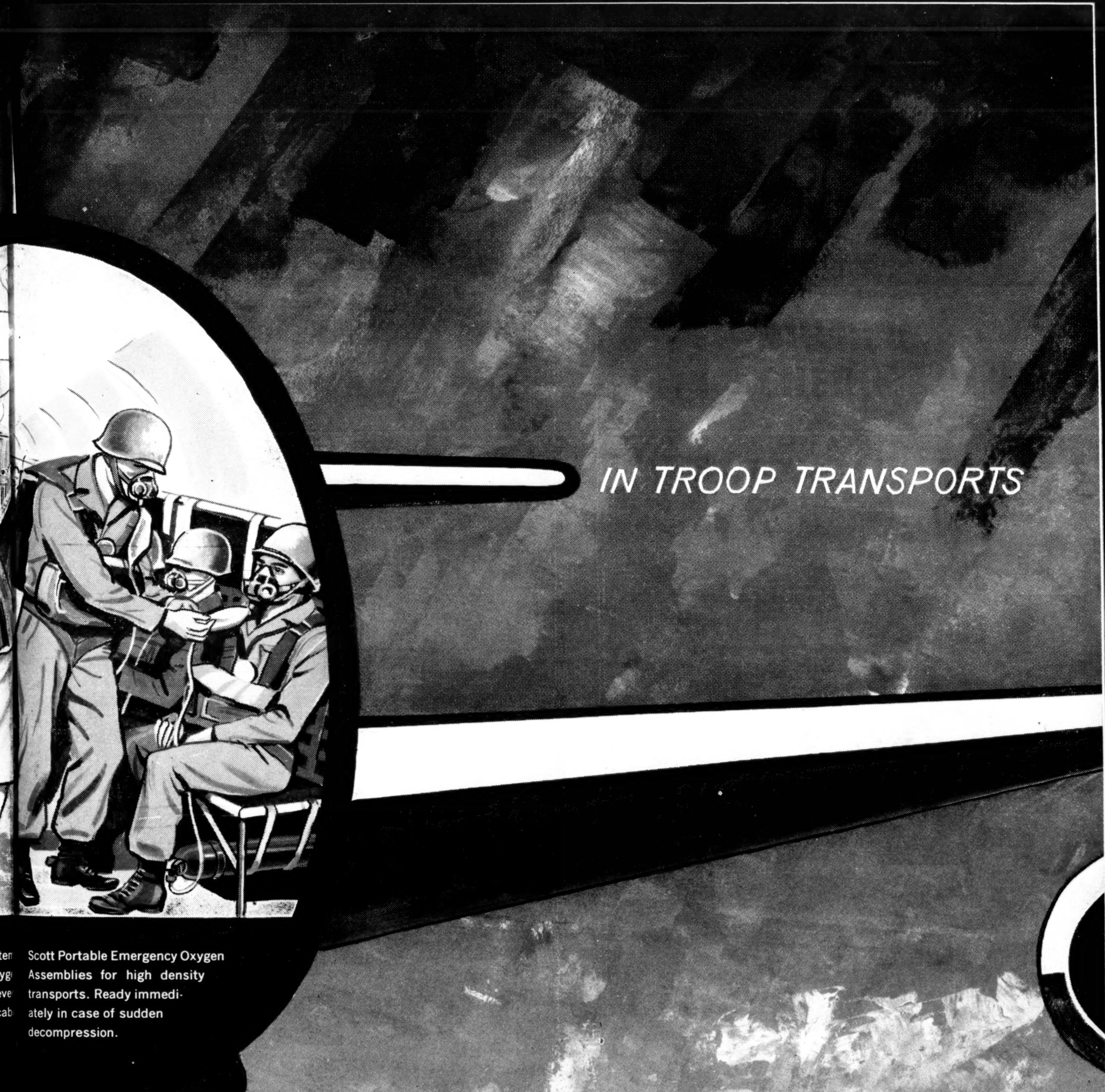

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of the huge Russian Mi-6 flying crane at Tushino will prompt U. S. officials to a reconsideration of the flying crane concept (AW July 24, p. 30).

The proposed Storc would be powered by tip-mounted turbojet engines for both rotary and fixed-wing operations to eliminate the weight of transmission gear trains. Hiller engineers say suitable engines now exist for rotor tip installation on helicopters of this size and are specifying the Continental J69-T-29 for the Storc.

They believe trends in helicopter design are also producing traits that make a convertible aircraft feasible. They have not made the helicopter more efficient but bigger ratios of power to weight have produced larger rotor blade areas. If blade area approaches the wing area of fixed-wing aircraft of the same general size, the Storc conversion obviously becomes feasible. It is expected to eliminate 90% of the faults which have caused the military services to reject past flying crane designs. Hiller engineers calculate that as the speed and power demanded of helicopters continue to grow, optimum blade area and blade aspect ratio will approach the areas and aspect ratios of fixed wings.

Design compromises needed in the Storc concept are called minor. The main one seems to be the necessity of using an untwisted, asymmetric airfoil which reduces rotor efficiency by a few per cent. Such an airfoil must be used because the convertible blade in one configuration will be upside down with respect to the other configuration. The symmetrical airfoil does not penalize helicopter performance because most helicopters have symmetrical airfoils anyway to get a fixed center of pressure. Small compromises in the choice of engine size and blade area will probably have to be made to get the optimum balance between airplane and helicopter design features.'

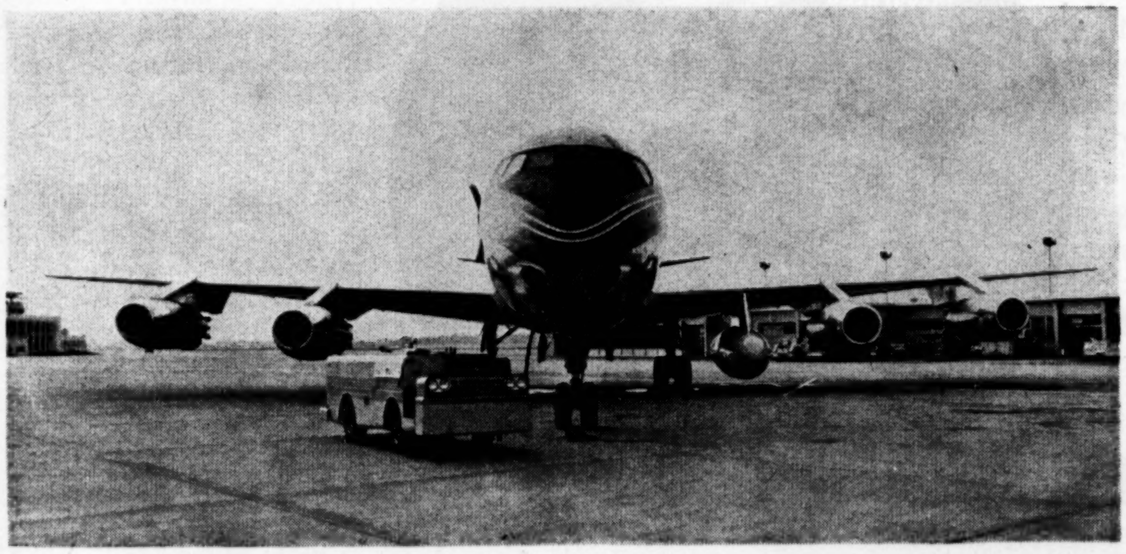
The Storc is envisioned as a means of moving heavy equipment and supplies in the combat zones of a small war area.

For swift deployment from the continental U. S., the Storc would be flown as an airplane to a prepared airfield within 50 or 100 mi. of the combat zone, converted to a helicopter and loaded with fuel for flying crane operations.

Conversion Procedure

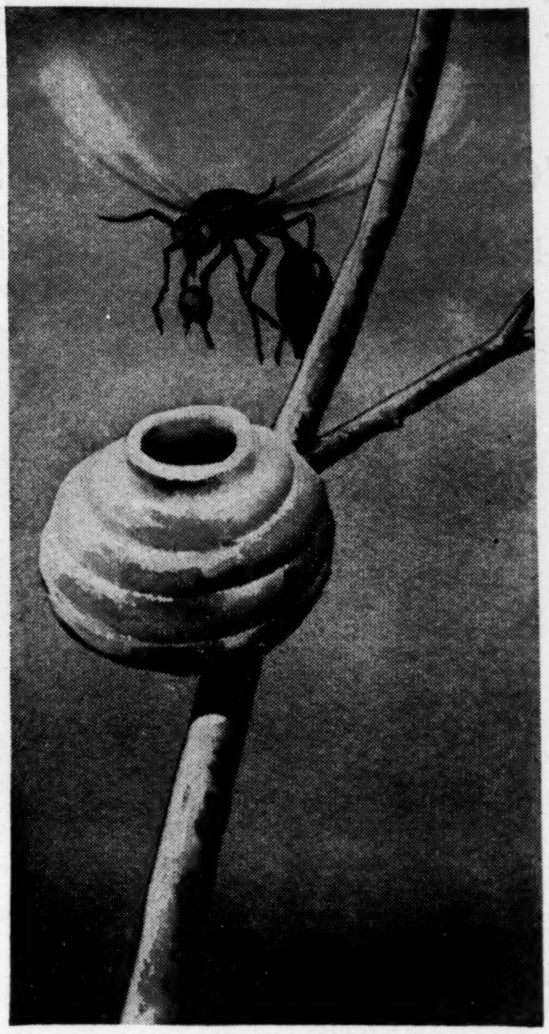
Conversion from helicopter to airplane would be performed by disconnecting wing struts, raising the wing, aligning it fore-and-aft, and pre-coning it. The struts would then be folded upward and inboard hydraulically and locked to the hub to help carry the loads on it. One rotor blade would be turned over, the control system would be revised, and the louvers in tail fan duct would be opened to permit helicopter directional control. Four-point landing gear mounted in wide-spread outriggers are proposed to leave the space directly under the fuselage and the rotor hub available for a load of cargo in a net, on a pallet, or in a streamlined pod. The wingtip-mounted engines would seem to create a problem in overriding asymmetric thrust if an engine were to fail in the fixed-wing condition.

Aspect ratio of the Model 1098 Storc is set at 14.1. This is more conservative than that of the French-built fixed-wing Hurel-Dubois H.D. 32 short-field transport. As an airplane, the Model 1098 would have a maximum gross weight of 72,000 lb. and as a helicopter, it would have a maximum gross weight of 60,000 lb. It would have an airplane wing loading of 70.6 psf. and a helicopter disk loading of 5.3 psf.



TCA DC-8 Flies With Five Engines

Trans-Canada Air Lines carries spare engines from its main engineering and maintenance base at Montreal to line stations across its route system by mounting the fifth engine in a pod on the underside of the wing midway between the left inboard engine and the fuselage. Airline chose the method because the 10½-ft. long Rolls-Royce Conway jet engines which power the DC-8s, are too large to be accommodated inside any of the other TCA transports.



Engineered Environment

The thimble-sized nest of the potter wasp is a feat of engineered environment as well as artistry. The mother wasp carefully gathers hundreds of particles of wet clay and positions them inside the nest so that air can circulate around them. This maintains proper humidity for larvae during the hot, dry months.

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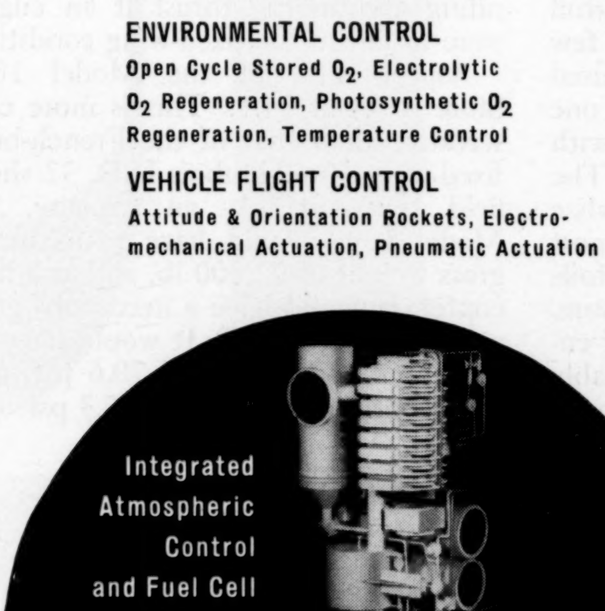
Fuel Cell, H_2-O_2 Dynamic, Hydrazine Dynamic, Solar Dynamic, Solar Thermionic, Systems Utilizing Nuclear Energy

ENVIRONMENTAL CONTROL

Open Cycle Stored O_2, Electrolytic O_2 Regeneration, Photosynthetic O_2 Regeneration, Temperature Control

VEHICLE FLIGHT CONTROL

Attitude & Orientation Rockets, Electromechanical Actuation, Pneumatic Actuation



TRW TAPCO

Thompson Ramo Wooldridge Inc.

23555 Euclid Ave., Cleveland 17, Ohio

PRODUCTION BRIEFING

American Orbitronics' Hawthorne, Calif., plant will supply Aerojet-General Corp. with $321,000 in components, including turbine rotors, for propulsion systems of Air Force Titan missile engines.

Bids for constructing an equipment testing and maintenance laboratory in the nuclear rocket propulsion experiment area of the Nevada Test Site will be opened at the Atomic Energy Commission's Las Vegas office Sept. 19. Plans and specifications for the building, to be a single story and of concrete and concrete block, will be available about Aug. 21 from Holmes & Narver, Inc., Special Projects Division, 849 S. Broadway, Los Angeles 14, Calif.

Atomics International is building a radiation gage to measure rocket engine fuel for the Air Force Systems Command. Gage will be used by Systems Division's 6593RD Test Group at Edwards AFB.

Avco Corp. will build three re-entry payload nose caps—one for flight test aboard a Scout, one for use as a backup payload and one for laboratory environmental testing—for the National Aeronautics and Space Administration. The caps, each containing 26 thermocouples for temperature measurements, will be used in conjunction with re-entry materials studies.

Hoffman Electronics Corp.'s Military Products Division, Los Angeles, has received an Air Force contract exceeding $3 million for additional 964 TACAN (Tactical Air Navigation) units.

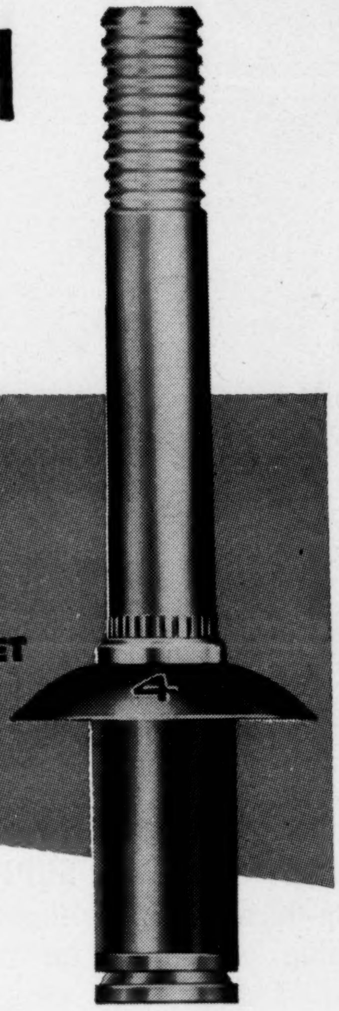
United Technology Corp. has received contracts from Air Force's Edwards AFB for research and development of an advanced high-performance solid propellant and from the Office of Naval Research for research in thermochemistry of the high-energy fluorine bond. Dollar value of the two contracts is about $230,000.

Raytheon Co., Andover, Mass., will produce field maintenance test equipment for the Hawk surface-to-air missile under $2,143,198 Army contract. The contract will run from June, 1961, to August, 1962.

Davy Crockett infantry atomic weapon afterbodies will be produced by Temco Electronics and Missiles Co., a subsidiary of Ling-Temco Electronics, Inc., Dallas Tex., under a contract from Picatinny Arsenal, Dover, N. J. Company will utilize shear-forming techniques to manufacture components.

SOLID RIVET STRENGTH WITH BLIND RIVETS

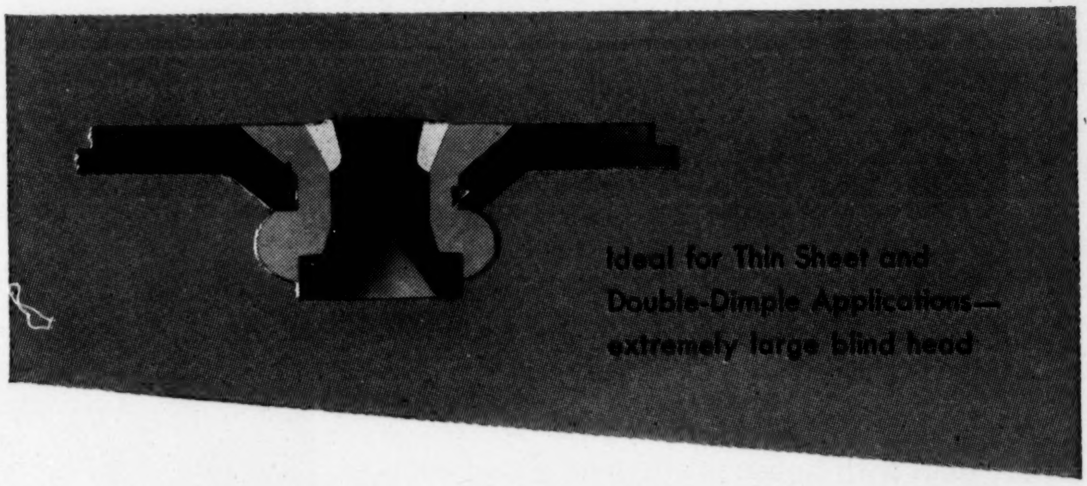
CHERRYLOCK RIVETS for Your Difficult Solid Rivet Applications



BULBED CHERRYLOCK

ONLY THE BULBED CHERRYLOCK RIVET GIVES YOU ALL THESE ADVANTAGES

Mechanically Locked Stem • Flush Fracture (No Stem Trimming) • Positive Clamp-Up • Full Grip Range • Complete Hole Fill • Minimum Blind Side Clearance • Positive Visual Inspection (Grip Length Marked on Head)



Ideal for Thin Sheet and Double-Dimple Applications—extremely large blind head

The Bulbed Cherrylock* offers a blind rivet that installs and performs like a solid rivet. Bulbed Cherrylock Rivets will qualify where you are now using solid rivets, offering higher joint strength with greatly increased joint reliability under critical loading conditions—fatigue, shake and sonic vibration.

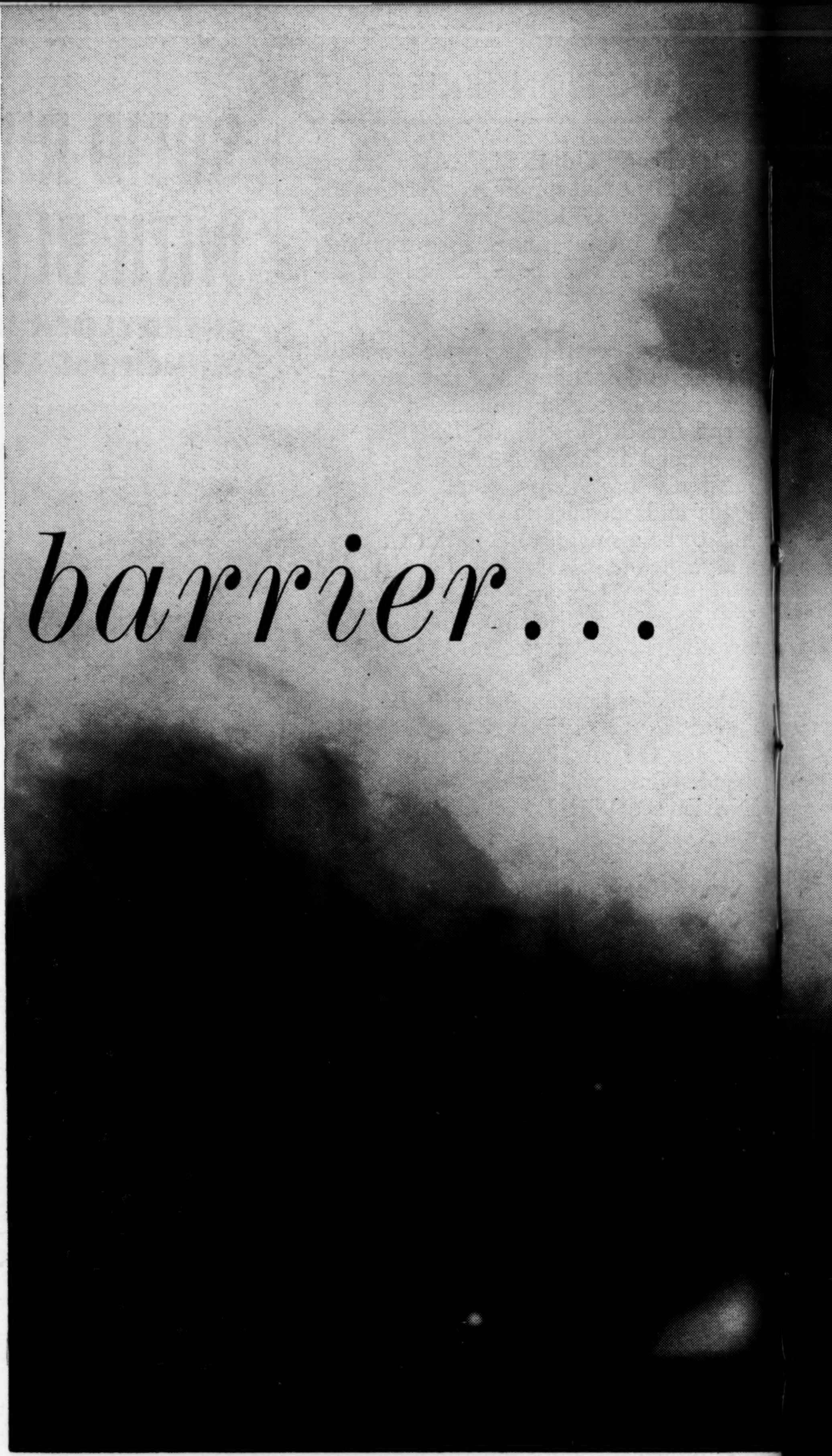
Now Cherrylock rivets give you a blind rivet that can be used in expensive forgings as well as for joining and attaching sheets and components.

For technical data on Cherrylock Rivets, write Cherry Rivet Division, Townsend Company, Box 2157N, Santa Ana, California.

* Patent Pending

CHERRY RIVET DIVISION
SANTA ANA, CALIFORNIA
Townsend Company
ESTABLISHED 1816 • BEAVER FALLS, PA.

In Canada: Parmenter & Bulloch Manufacturing Company, Limited, Gananoque, Ontario



the breath barrier...

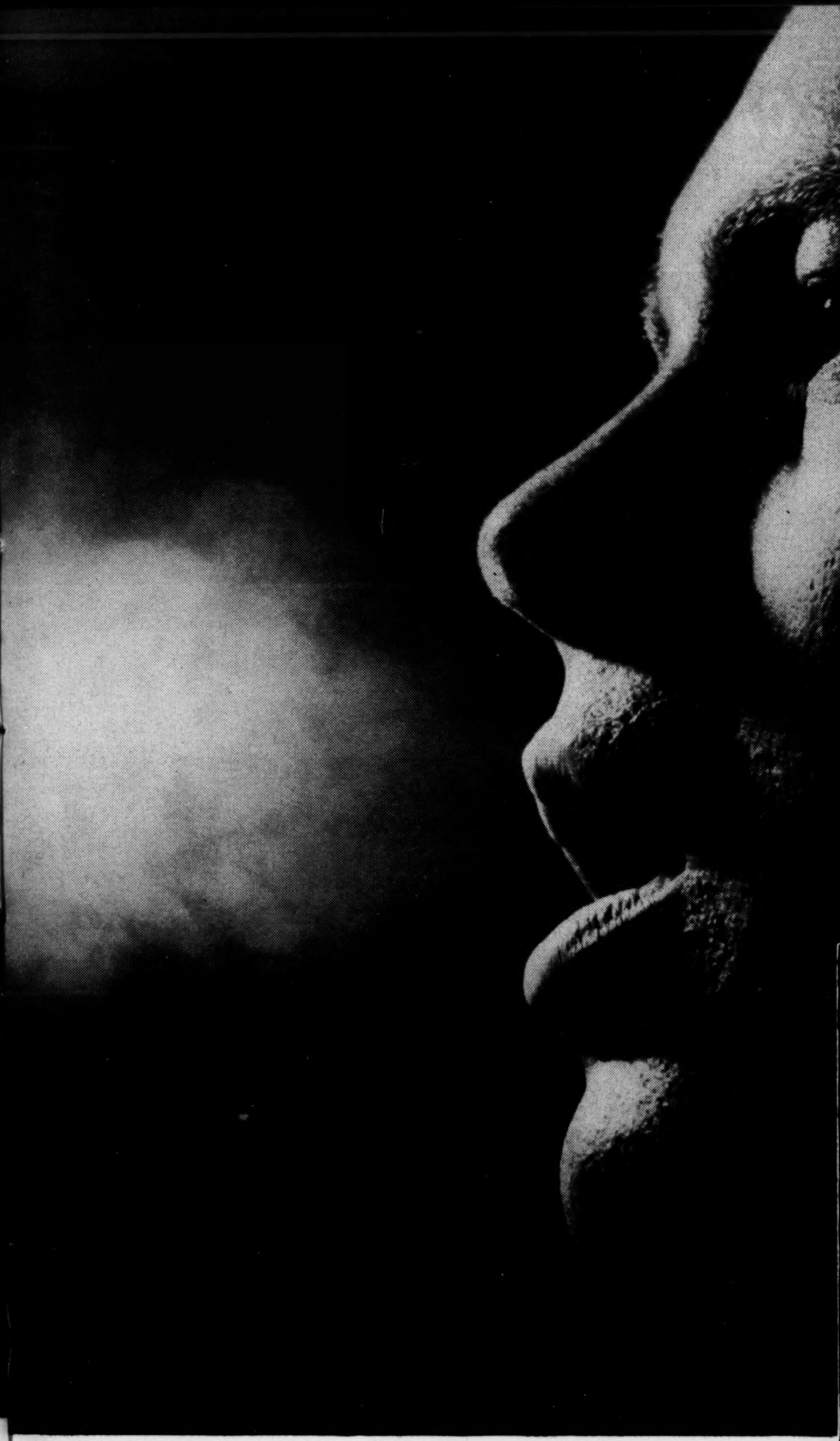
TO MEET THE LIFE SUPPORT REQUIREMENTS of long-duration space flights, a comprehensive, regenerable environmental control system will be needed. The primary design parameters: extreme reliability plus simple modular construction for easy maintenance. In addition, minute flow rates of liquids and gases must be metered under zero gravity conditions . . . improved components must be developed to prevent even infinitesimal leakage . . . proven techniques in systems dynamics and integration must be applied to assure dependability.

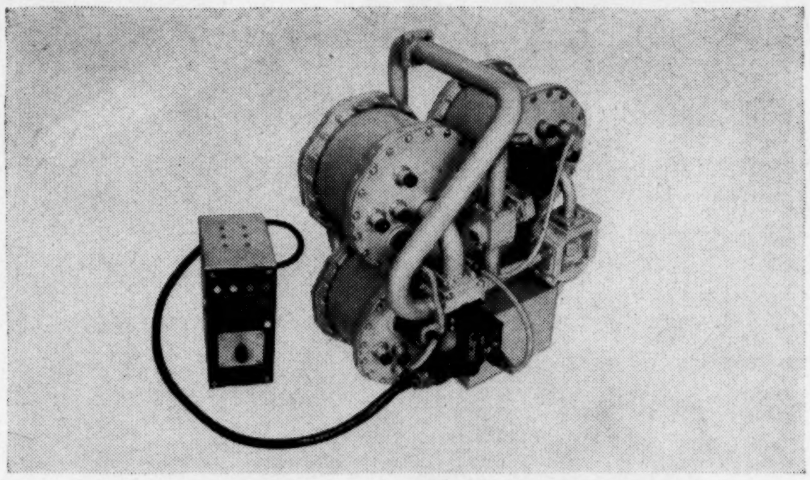
CURRENT HAMILTON STANDARD WORK in space life support is based on the use of many components which are presently within the state of the art. The entire space ECS design includes . . .

- a thermal control subsystem which utilizes a transport loop with aqueous ethylene glycol coolant to provide heat rejection to the ultimate sink.
- a contaminant and trace gas removal subsystem, utilizing conventional filter techniques, non-regenerable solid absorbents, or a unique regenerable solid adsorbent system, for removal of noxious and toxic gases.
- a partial and total pressure-control subsystem, operating from cryogenically stored fluids to provide a normal environment without special clothing.
- Instrumentation for monitoring all significant variables, plus emergency enunciation.
- Corollary subsystems which satisfy pre-launch, launch, mission, re-entry and emergency situations.

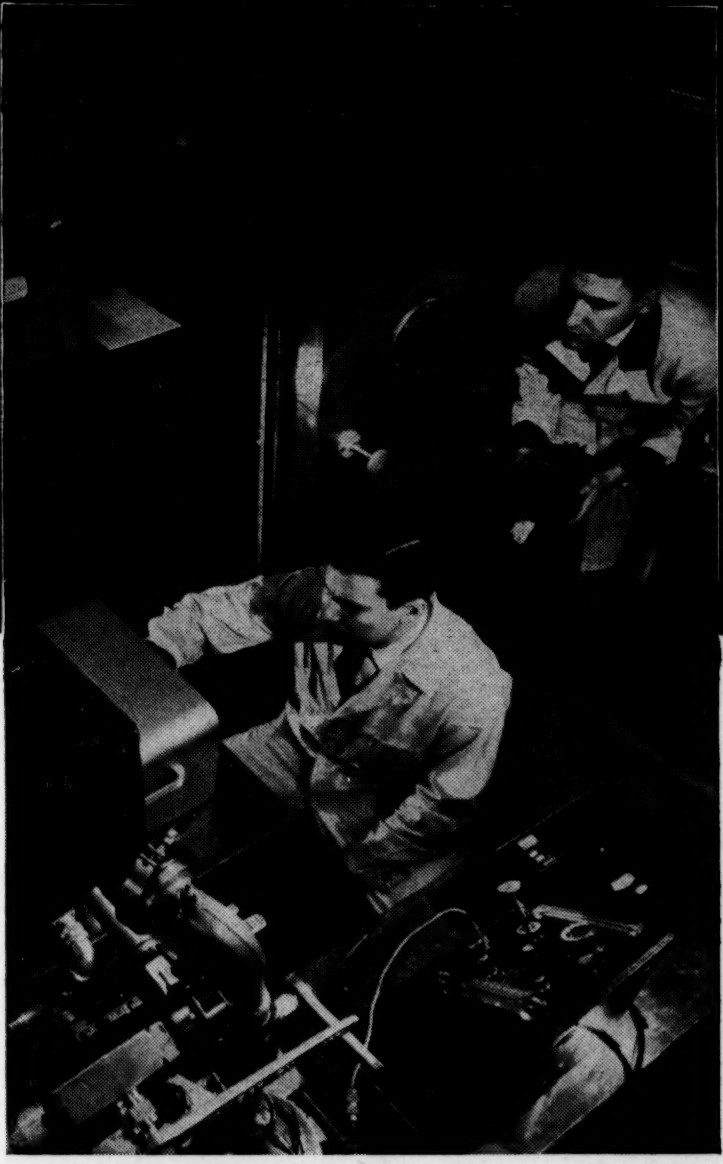
IN AN INTENSIVE PROGRAM begun three years ago, Hamilton Standard has already developed, built, and tested some of the basic equipment to be used. Moreover, a vast pool of fundamental research data has been accumulated which will greatly facilitate production of the system. This work is a logical evolutionary extension of experience that Hamilton Standard has amassed in the production of ECS for such advanced aircraft as the F-104, B-58, and B-70—the most comprehensive system ever developed for manned flight.

UNITED AIRCRAFT CORPORATION
HAMILTON STANDARD DIVISION
LIFE SUPPORT SYSTEMS





CO₂ REMOVAL UNIT could, in present form, sustain three men in a sealed capsule indefinitely. Several of these units, have already accumulated hundreds of hours of testing. One assembly, operating under a 3-man load in the Moon Room, recently passed 100 hours of continuous endurance testing, and is scheduled for further tests by NASA.



MOON ROOM, a 550 cubic foot closed environment laboratory, simulates isolated-cabin conditions for up to five men. Here, Hamilton Standard has performed development tests involving weight, configuration, volume, power requirements, and reliability of a variety of space ECS equipment.

ALCOA CAPABILITY AT WORK . . .

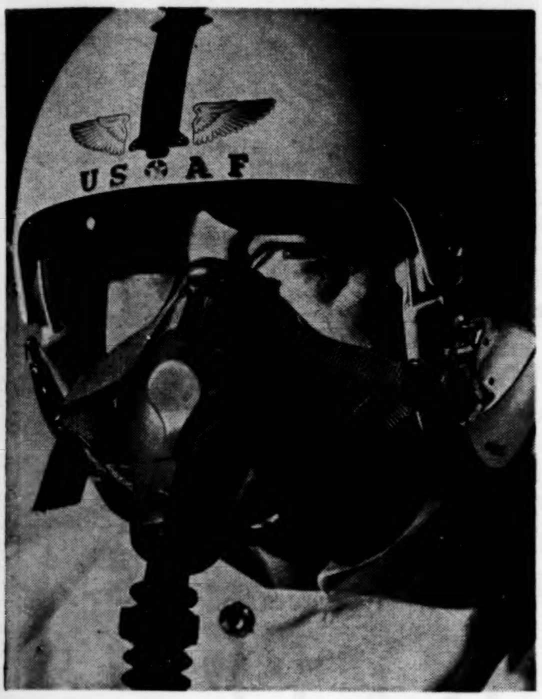
18 ½″ wide

with 24 air passages . . . extruded

ALCOA ALUMINUM

ALUMINUM COMPANY OF AMERICA

NEW AEROSPACE PRODUCTS



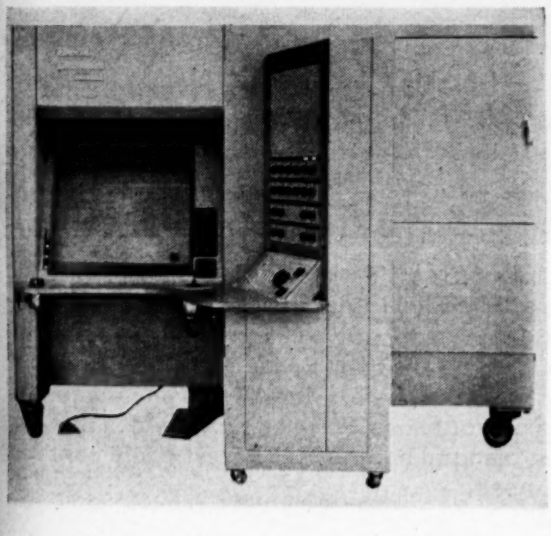
Oxygen Mask

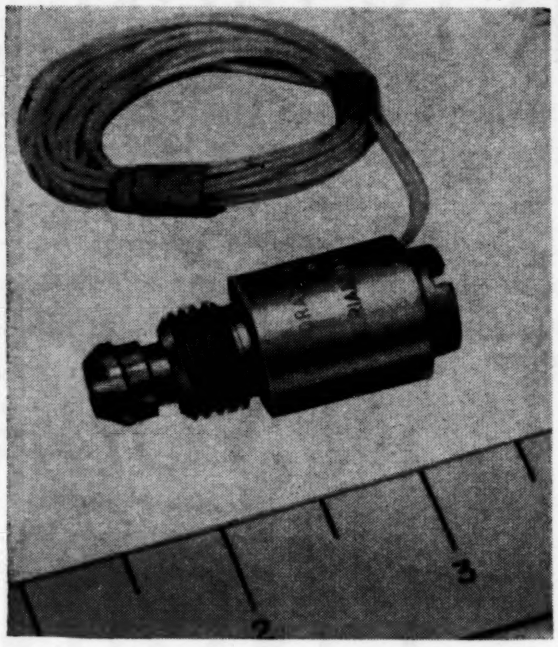
Lightweight oxygen mask made of silicone rubber provides greater safety and reliability for military crews flying high-altitude aircraft. It was developed for the Air Force jointly by Union Carbide Corp. and General Tire Corp. Mask weighs only 11 oz., has positive seal at extreme altitudes and is reportedly more comfortable than earlier models.

Film Reader

Console-type film reader converts X-Y coordinates of points in nuclear photomicrography to digital data. Accurate alignment of film point and center-screen reticle is effected by optical system and chopper, the latter translating split mirror images emerging from the prism assembly into electrical impulses. Pulses are presented on oscilloscope as wave forms and film platen, then moved by joy-stick until wave forms coincide. Joy-stick movements are encoded as X-Y coordinates and results are printed out either on tape or cards. Company says reader, which also features automatic operation, is adaptable to analysis of continuous missile trajectory or satellite orbit photography. Accuracy: ±3 microns. Power: 115 v., 60 cps., 23 amp. max. Dimensions: 73 in. tall, 66 in. wide, 91 in. long. Weight: 2,800 lb.

Hermes Electronics Division of Itek Corp., Cambridge, Mass.

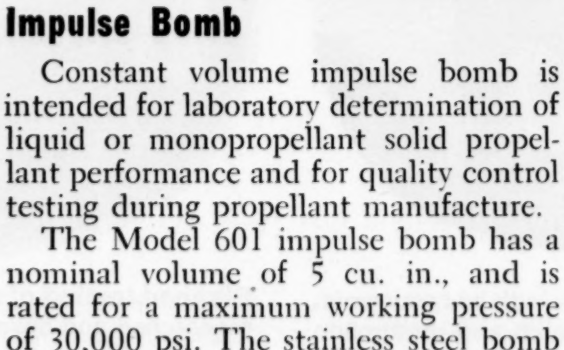




Low Leakage Cryogenic Valves

Miniature cryogenic valves feature hardened seat for longer life and range from 100 psi. to 4,000 psi. in capacity. They will operate from −425F to +300F. Functional tests using 1,000 actuations at various temperatures showed zero leakage in the 70F range with leakage as low as .5 cc at −300F at 3,000 psi.

Hydraulic Research and Manufacturing Co., 2835 N. Naomi, Burbank, Calif.

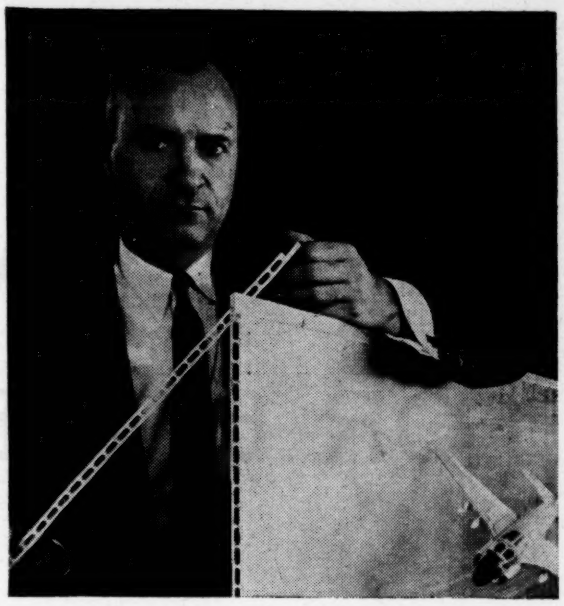


Impulse Bomb

Constant volume impulse bomb is intended for laboratory determination of liquid or monopropellant solid propellant performance and for quality control testing during propellant manufacture.

The Model 601 impulse bomb has a nominal volume of 5 cu. in., and is rated for a maximum working pressure of 30,000 psi. The stainless steel bomb is complete with firing circuit and pressure transducer requiring only a recording system to receiver outputs.

Technoproducts, Inc., P.O. Box 5293 Hamden 18, Conn.



18½" WIDE WITH 24 AIR PASSAGES ...EXTRUDED

The aluminum extrusion in the picture is a metal-working "first." It is 18½ in. wide and has 24 internal passages running its entire length. Passages are ½ in. wide, 3⁄16 in. high and spaced ¼ in. apart.

The extrusion is cut to required lengths to form panels. The panels are made into pressurized cabinets that house electronic equipment for high-altitude aircraft. Cool air forced through the passages air-conditions the equipment for greater operating efficiency. These panels or similar extruded parts could also carry gases or liquids to overcome heating or cooling problems in other applications.

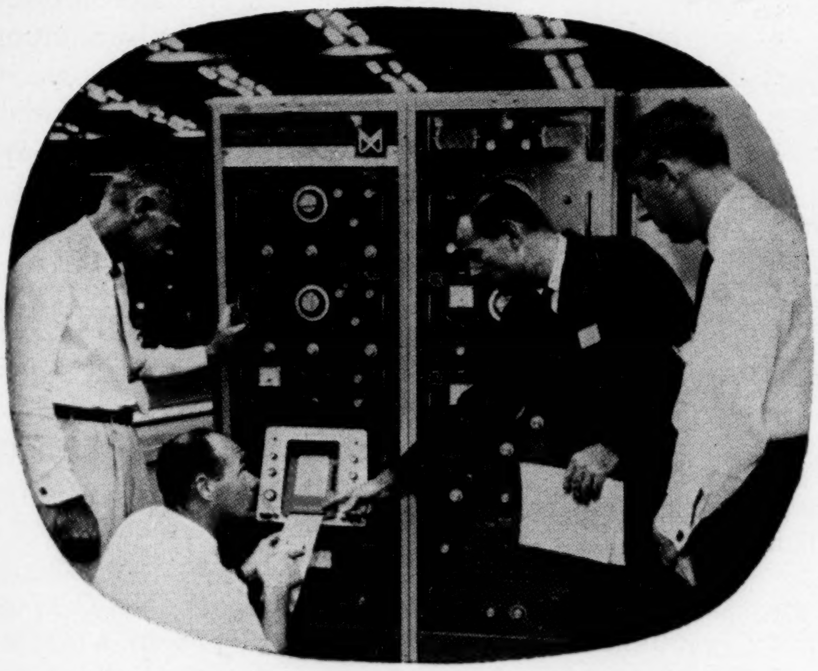
CALL ON ALCOA'S CAPABILITY

This extrusion "first" is a significant example of Alcoa capability at work. Alcoa . . . where the men, the metal and the machines can roll, forge, extrude or cast the solution to your metal problems. How can we help you use this capability? Write: Aluminum Company of America, 1870-V Alcoa Building, Pittsburgh 19, Pennsylvania.

ALCOA ALUMINUM
ALUMINUM COMPANY OF AMERICA

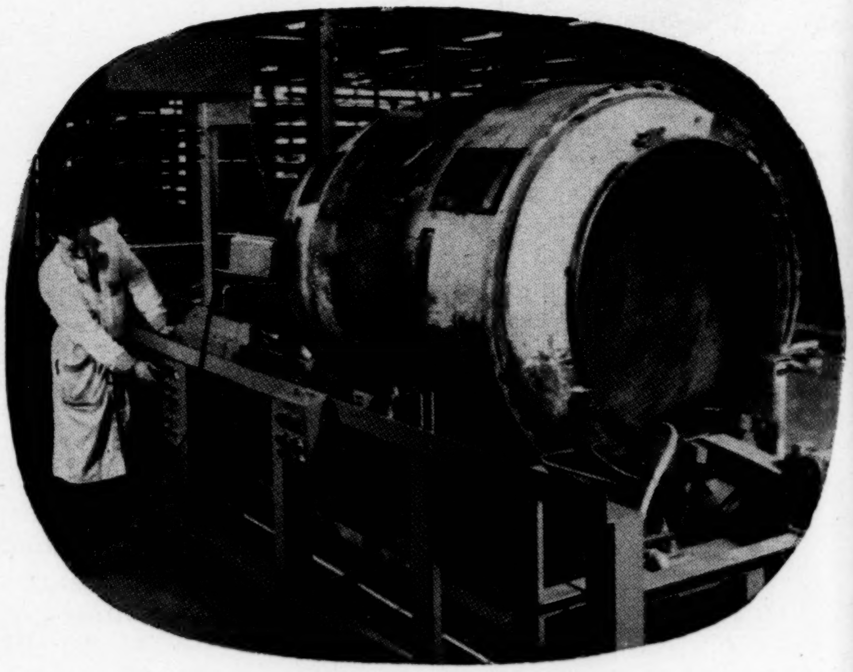
FOR RELIABILITY CONTROL...
FOR BETTER DESIGN...

PLAN NDT* IN YOUR R&D, ENGINEERING, PRODUCTION



Planned testing of critical tubing ⅛″ to 6″ O.D. with eddy currents. Magnatest FW-400 is used here for both research and production testing of stainless steel and aluminum tubing. It is one of a broad line of Magnatest units testing nonmagnetic tube, rod and wire—for seams, inclusions, voids, concentrated porosity, embrittled areas, slivers, laps, etc. Defects are reported on the scope and/or other readout, at mill speeds if necessary.

Photo courtesy GENERAL DYNAMICS/FORT WORTH



Planned testing of rocket motor solid fuel chambers. This specially researched and developed Magnaglo unit provides multi-directional magnetization for positive detection of all crack-type defects. In designing specialized-purpose units like this for inspection of highly critical components and parts, Magnaflux draws upon an impressive background of hundreds of thousands of man hours spent in its own R & D, and experience in planned engineering of test equipment for virtually every industrial need.

NDT*: Nondestructive Testing works best and saves you most when it is planned for at the beginning—not added at the end.

NDT can help assure reliability of your finished products, of course. But your greatest benefits come when adequate testing considerations are introduced as early as possible in the R & D and design stages, with more thought given to filling missions than filling arbitrary specifications. It is no longer enough to keep defective parts and machines off the launching pad, or out of the airplane—or even out of the production line. Test practices must consider the need of the end use of the item, using the best test method, regardless of its type.

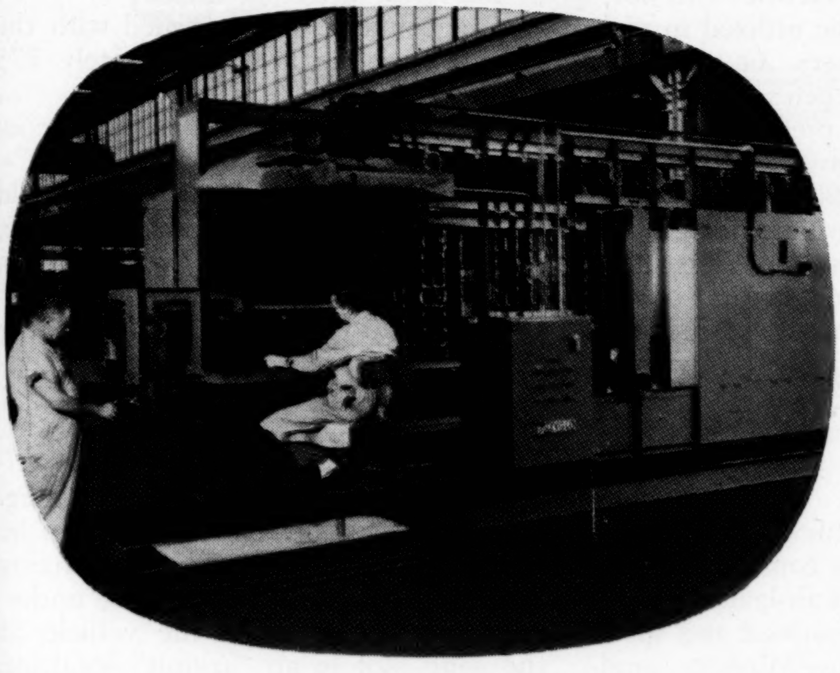
Such benefits in reliability—and production savings, too—can be realized every day, with Magnaflux Test Systems planned for and used at every stage from first concept to full production testing. Whether for large volume, or few-of-a-kind critical parts, or prototypes, Magnaflux offers you the widest variety of different test systems and methods.

A few typical examples are shown here. Many others could be. For your own requirements—however commonplace, critical or specialized—there is usually a Magnaflux Test System. Call your Magnaflux Field Engineer—or write Magnaflux Corporation, 7306 W. Lawrence Avenue, Chicago 31, Illinois.

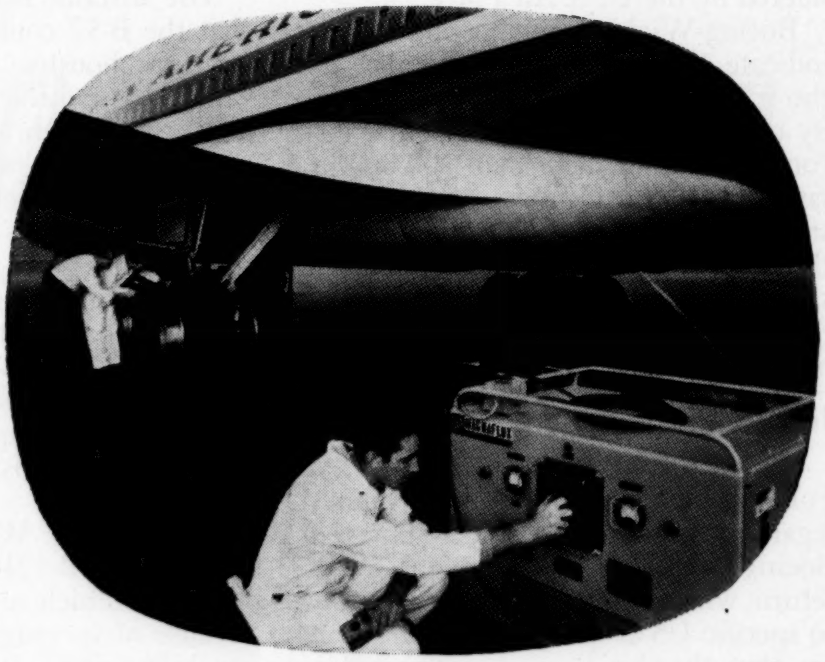
MAGNAFLUX CORPORATION
TEST SYSTEMS

General Mills
A SUBSIDIARY OF GENERAL MILLS

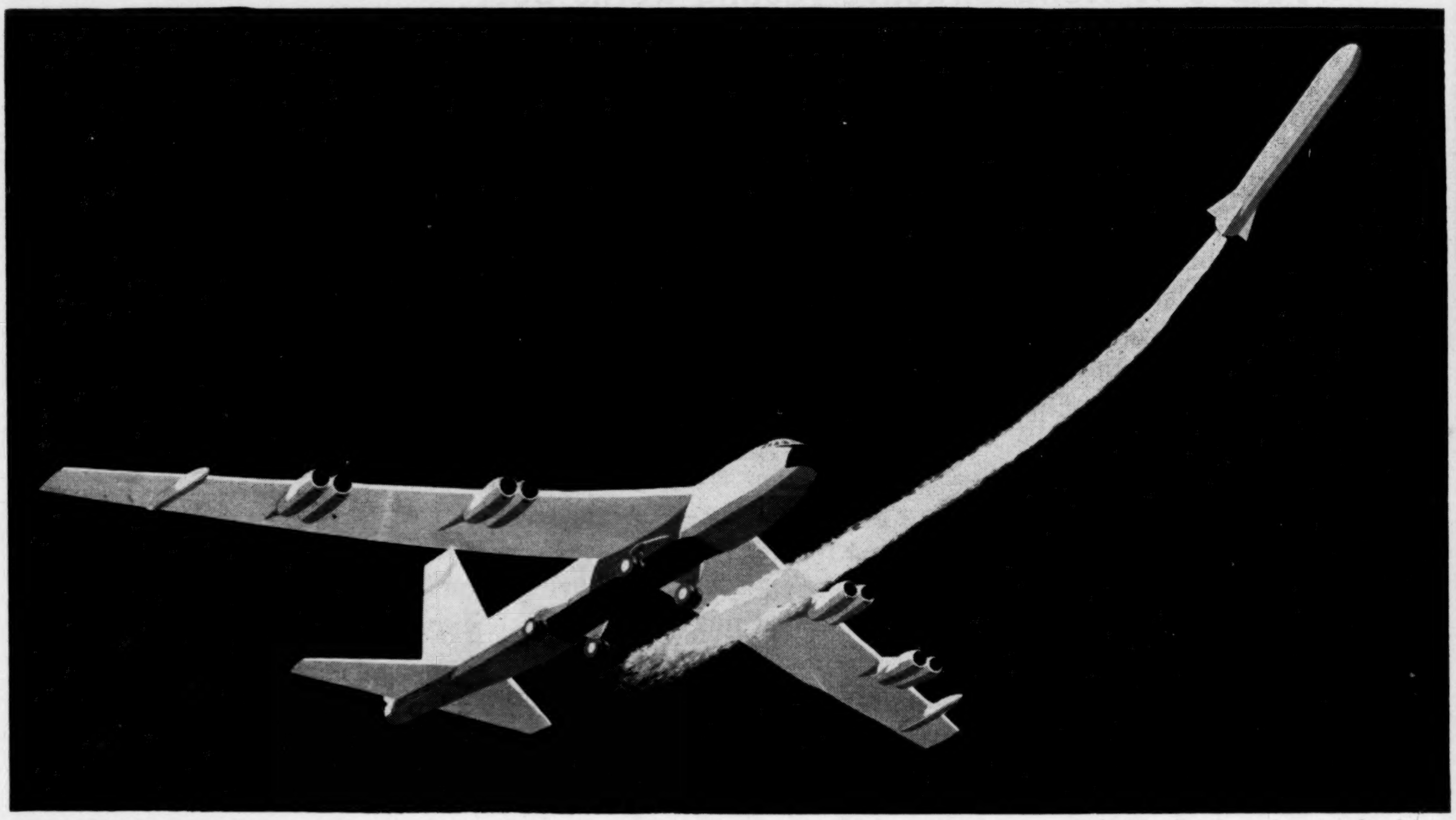
MAGNETIC PARTICLE • FLUORESCENT PENETRANT • ULTRASONIC • EDDY CURRENT • STRESS ANALYSIS RADIOGRAPHY • DYE PENETRANT MAGNETIC FIELD MEASURE • THERMOGRAPHIC



Planned testing of bearing cages. This is a specialized, automated Zyglo Fluorescent Penetrant System with which one man tests up to 375 nonferrous bearing cages per hour for cracks, porosity or leaks. It includes complete conveyorized handling and programmed processing, custom engineered and built by Magnaflux. Parts tested range from ¾" I.D. to 10" O.D. Twenty-six different Zyglo Penetrants have been developed by Magnaflux to produce precise, 100% reproducible results, assure sensitivity to meet all needs.



Planned apron check of a jet liner's main gear is made with Magnaflux KCH-3D and black light. Such tests are routine to assure safety on major airlines serving throughout the world. Magnaflux units like this are versatile, and are also used in all sorts of industrial maintenance operations as well as in production testing of large castings, structural weldments, etc. Photo is of Pan American Boeing 707 at Idlewild Airport, New York.



ARTIST'S CONCEPT indicates how the Boeing B-52 with fixed landing gear could be utilized as a recoverable first-stage booster for future satellite launches. In some configurations studied the landing gear could be retracted.

B-52 Use as First-Stage Booster Studied

By Erwin J. Bulban

Wichita, Kan.—Use of the Boeing B-52 Stratofortress bomber as a recoverable first-stage booster having a proven reliability to air-launch large satellite vehicles and their payloads is being considered by the U. S. Air Force.

Boeing-Wichita engineering studies indicate that the eight-jet bomber has the speed, altitude and payload capability of lofting combined booster-payload combinations of more than 200,000 lb., saving the considerable cost of first-stage booster powerplants plus having the ability to launch from optimum sites to achieve desired orbits rather than being restricted by present ground-based facilities.

Initial Presentation

Initial presentations before the Air Force have aroused sufficient interest regarding the merits of the system that Boeing-Wichita has been requested to return with detailed studies pertaining to specific USAF programs. Indications are that the Air Force is interested in using the B-52 launch platform for its Blue Scout research rocket. Boeing believes that its system can make possible launches of Blue Scout vehicles carrying larger payloads, or launching them with current payload weights using lesser stages.

Its studies indicate that the B-52 could have handled every satellite launched to date except the Discoverer vehicles, one Sputnik and those which are a part of man-in-space programs.

Booster Stage Pickups

The airframe manufacturer also notes that the B-52 could be utilized in picking up booster stages or complete vehicles at contractor sites and ferrying them to launch or prelaunch takeoff sites at savings in cost and time over present surface methods. Thus far, however, presentations have considered only the savings in costs of first-stage boosters, including reusability of the B-52, and have not considered the additional savings involved in transporting the boosters or vehicles or the real estate and facilities required in additional "Cape Canaverals," Aviation Week was told.

The Pratt & Whitney TF-33 turbofan-powered B-52H is considered as an optimum vehicle in the air-launch system because of its range, payload and speed capability, but Boeing-Wichita engineers feel that the B-52F and G, or possibly earlier models are also adaptable to the program since launchings would be planned to minimize weather problems. Since detailed discussion of the weight-range-altitude capabilities by model would tend to disclose B-52 weapon system characteristics, only general data, not identifying a particular version of the Stratofortress are available.

Basically, the Stratofortress could air-launch from over 35,000 ft. to well over 60,000 ft., lofting the heaviest payload at the lower altitudes.

This could be accomplished with the aircraft traveling at approximately 375 kt. TAS.

Carrying the heaviest payload—considered in the "over 200,000-lb.-class"—the Stratofort mobile launch pad would have at least five hours of flight time, which would include an hour of loiter, unrefueled.

Routine air refueling could extend the aircraft's mission capabilities considerably.

Payload Configuration

Depending upon the payload configuration and weight, the airplane can be modified for various stowage—utilizing Hound Dog air-to-surface missile underwing mounts, carrying the vehicle at the wing root in an "armpit" location, or centrally mounting it in the belly. The latter location, favored because it reduces need for offsetting asymmetrical loading and drag and makes possible storage of much of the vehicle inside the belly, thus providing some access to it prior to launch, would require fixing

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AIRCRAFT
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announces

BAC

ONE-ELEVEN

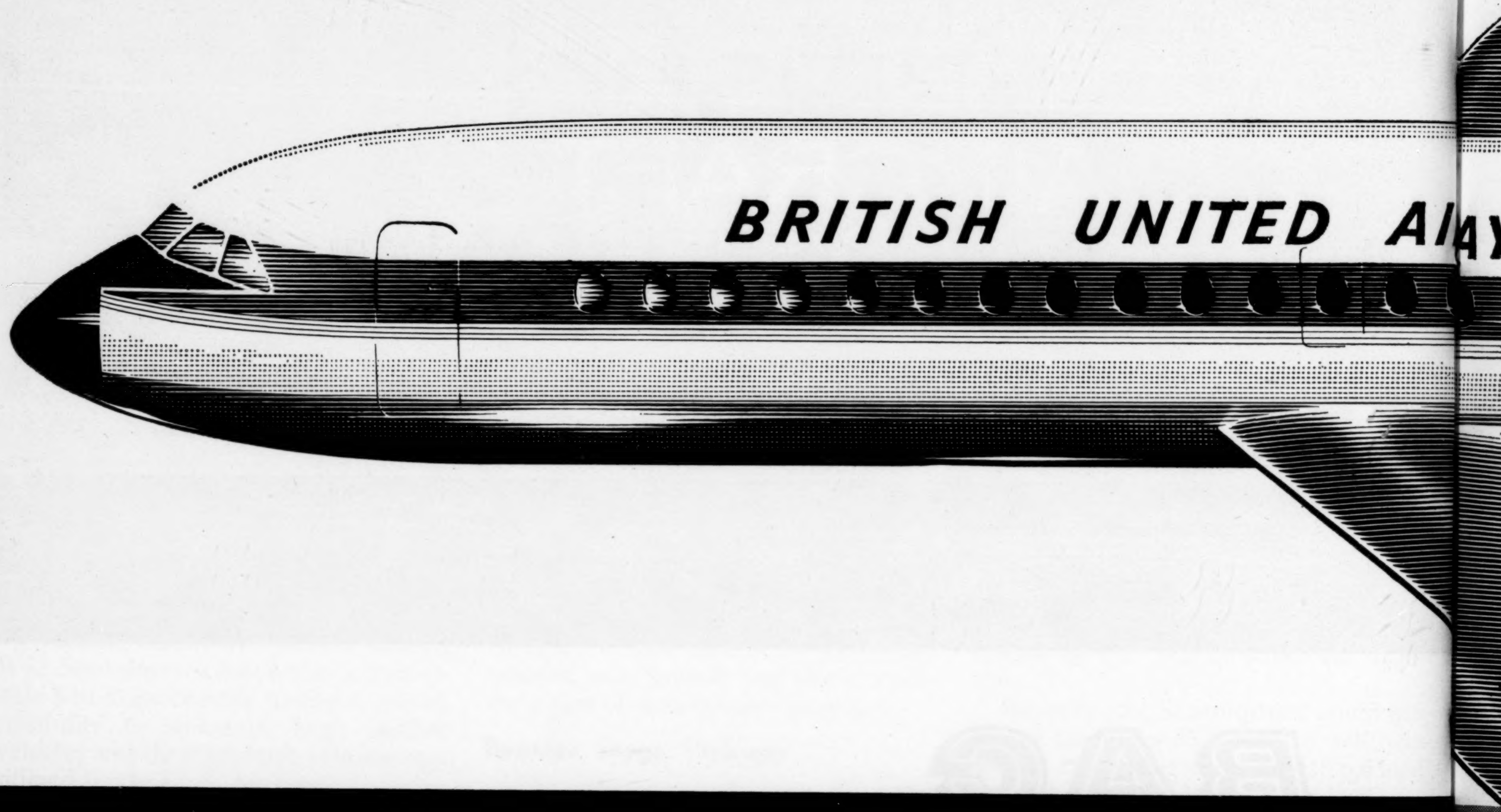
THE SHORT HAUL JET

JET SUCCESSOR TO THE VISCOUNT

BRITISH UNITED

CHOOSES

THE SHORT HAUL JE


BRITISH UNITED AI

JET SUCCESSOR TO THE VISCOUNT
WITH EVEN BETTER THAN VISCOUNT ECONOMICS

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AIRWAYS

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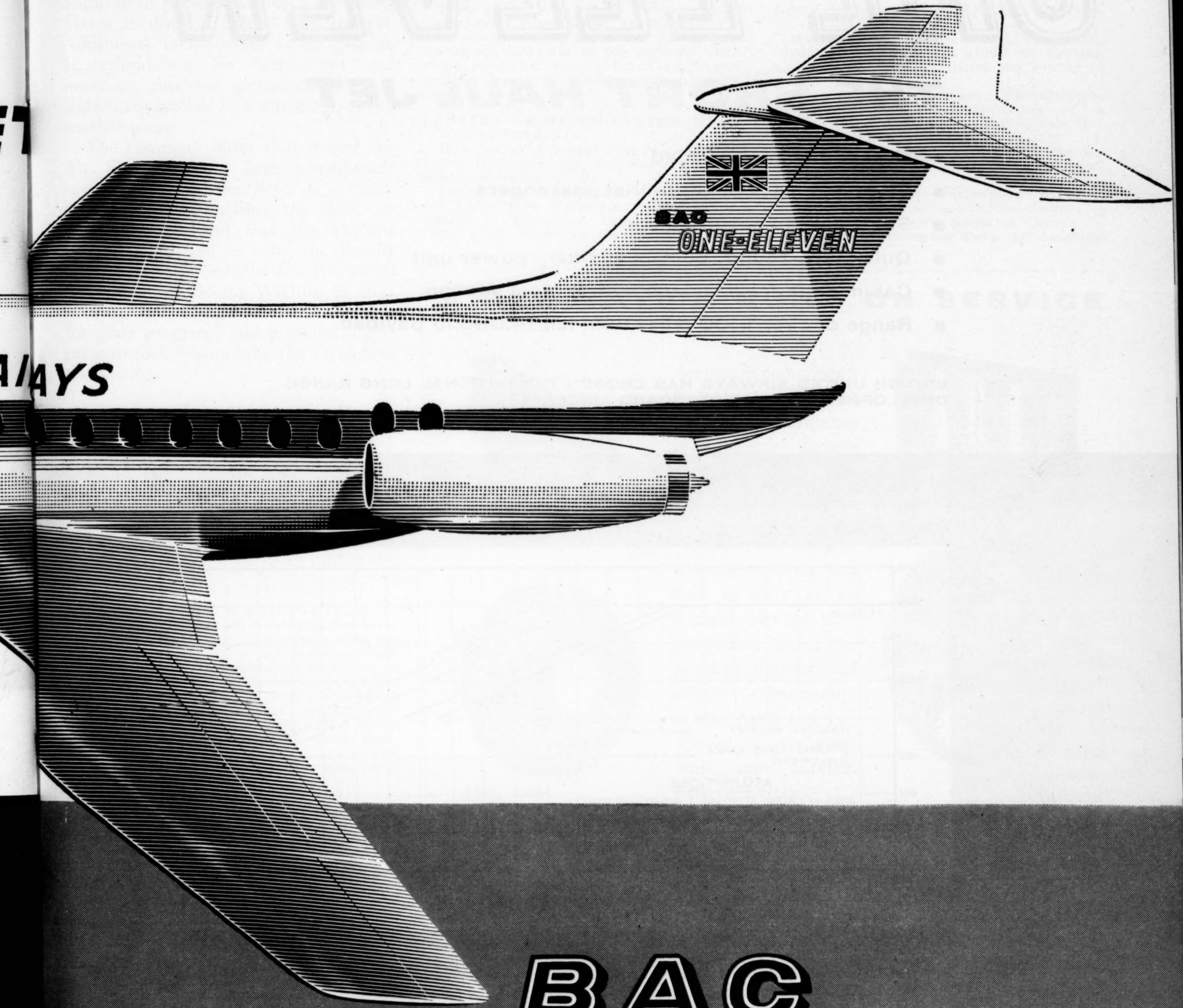
AYS
BAC
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TWO ROLLS-ROYCE SPEY TURBOFAN ENGINES

...and built by

BRITISH AIRCRAFT CORPORATION

BAC ONE-ELEVEN

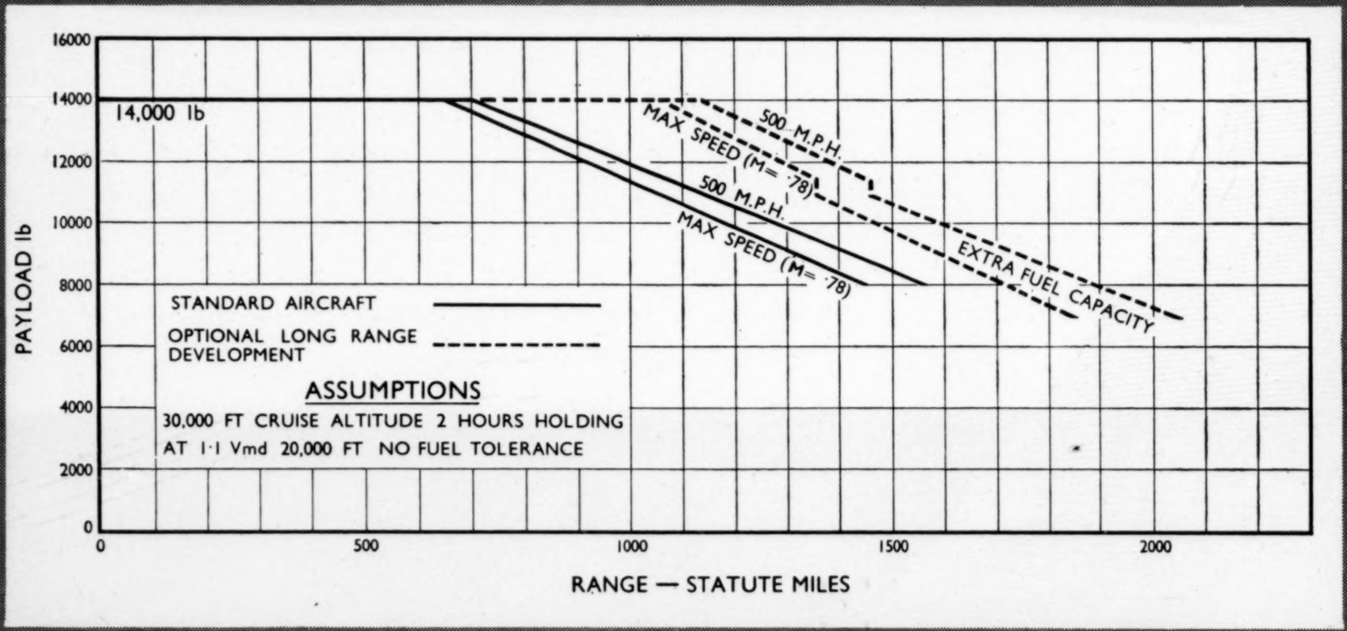
THE SHORT HAUL JET

- 540 m.p.h. cruise speed
- 57 mixed class or 69 tourist passengers
- Short airfield performance
- Quick turn-round: built-in auxiliary power unit
- Cabin width for spacious five-abreast seating
- Range of over 1,100 miles with full 14,000 lb payload

BRITISH UNITED AIRWAYS HAS CHOSEN THE OPTIONAL LONG RANGE DEVELOPMENT OF THE STANDARD AIRCRAFT

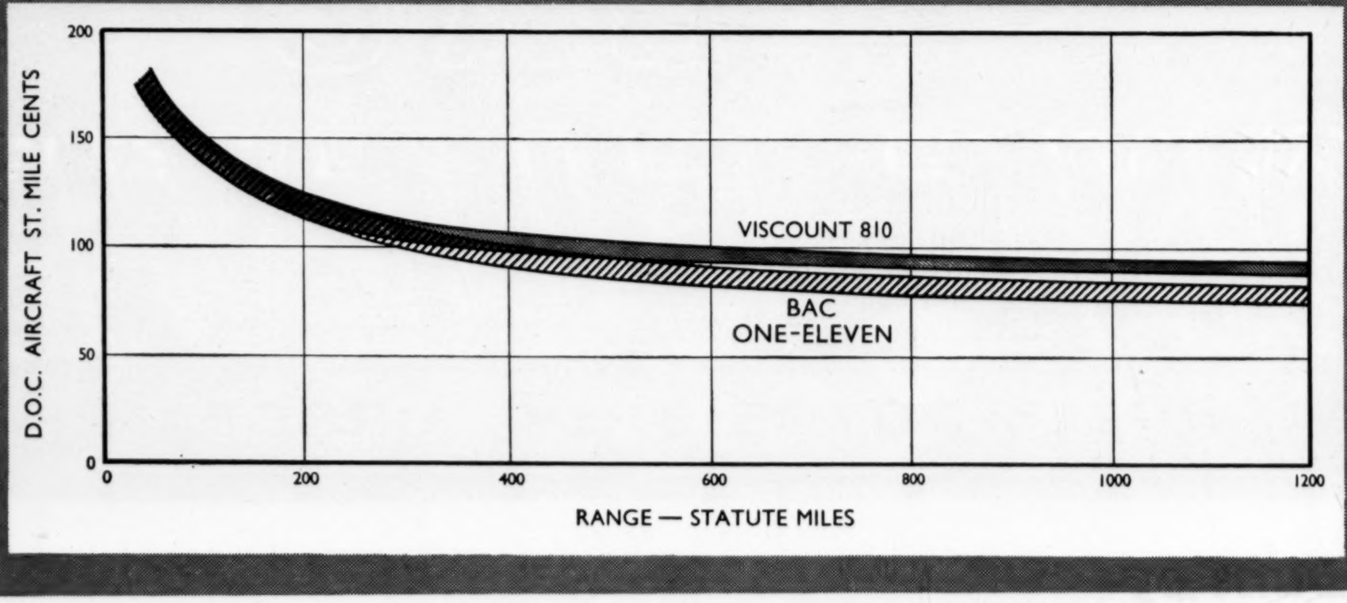
PAYLOAD v. RANGE

The BAC One-Eleven can carry its full complement of 57 mixed class passengers and baggage at 500 mph for stages of 1,070 statute miles with two hours reserves. It can carry 43 passengers for 1,500 miles



ECONOMICS

These bands cover seven separate methods of costing —ATA (1955), ATA (1960), SBAC and those of four airlines



BRITISH AIRCRAFT CORPORATION

ONE HUNDRED PALL MALL LONDON SW1 ENGLAND
USA: BRITISH AIRCRAFT CORPORATION (USA) INC.,
399 JEFFERSON DAVIS HIGHWAY ARLINGTON VIRGINIA

the main landing gear to prevent interference with the payload.

In some of the configurations studied, the landing gear could be retracted, providing the forward gear was relocated ahead of its present location. One layout places it directly behind the cockpit. Additional modification could provide accommodation for technicians and necessary checkout and some data collection equipment in the fuselage of the mother plane.

The company notes that it and the Air Force already have considerable experience using the B-52 as a "first-stage" for air-launching the X-15 research aircraft and that the airplane is also programed to carry the Boeing Dyna-Soar test vehicle for its initial test program. Boeing-Wichita is engineering the mating of the latter vehicle for glide programs and powered flights prior to rocket-launching the Dyna-Soar test vehicle.

NASA Contracts

National Aeronautics and Space Administration awarded the following contracts and research grants during April, 1961. The figures shown represent the total estimated cost of contracts of $50,000 or more let during the period.

HEADQUARTERS, WASHINGTON, D. C.

University of Hawaii, Honolulu, Hawaii—$120,039—Research, in cooperation with the University of Colorado, on zodiacal light selected lines in the airglow spectrum.

Leland Stanford Junior University, Stanford, California—$76,500—Basic studies on space vehicle attitude control systems.

University of Michigan, Ann Arbor, Michigan—$50,000—Research on the basic principles pertinent to the selection and metallurgical treatment of alloys for structural use in supersonic aircraft.

General Electric Co., Philadelphia, Pennsylvania—$75,622—Study and evaluate passive (inert shielding materials) and active electrostatic and magnetic) radiation shielding systems, and carry out preliminary design studies of active shielding systems, to indicate means for reducing shielding weight requirements.

Sperry Gyroscope Co., division of Sperry Rand Corp., Great Neck, N. Y.—$85,815—Research on an electrostatic technique for low-level acceleration measurement. This research will include theoretical study, computer analysis, and experimentation with a three-axis (scale) laboratory model. Research to be conducted generally in accordance with contractor's proposal dated October, 1960.

University of California, Berkeley, California—$99,498—The contractor will conduct research on low-energy cosmic radiation from the sun, including (a) design and development detection apparatus suitable for inclusion in EGO payloads; (b) provide NASA with one prototype unit by Apr. 1, 1962 and two flight units by July 1, 1962; (c) analyze and interpret the resulting experimental data.

Wilmot Castle Co., Rochester, N. Y.—$106,880—Contract to perform research on sterilization of space probe components by dry heat, irradiation, or other techniques.

University of Michigan, Ann Arbor, Michigan—$81,500—Research on the use of electronic and mechanical apparatus and instrumentation for rockets and satellites.

Armour Research Foundation, Illinois Institute of Technology, Chicago, Illinois—$75,000—Contract for research on the effects of solar plasma and electromagnetic radiation on thin films and surfaces.

Dept. of the Navy, Bureau of Medicine and Surgery, Washington, D. C.—$62,120—Conduct research into basic physiological mechanisms which defend the human body against heat and cold, and determine the extent and efficiency of energy transformations in the human body and in isolated body constituents at the molecular level.

Dept. of the Navy, U. S. Naval Research Laboratory, Washington, D. C.—$90,000—Conduct measurement of the optical constants of materials in the extreme ultraviolet, including construction of a reflectometer for use with existing vacuum monochromators.

LANGLEY RESEARCH CENTER, HAMPTON, VIRGINIA

U. S. Naval Ordnance Test Station, China Lake, California—$81,500—Motors, rocket spherical NOTS 100-B.

Compudyne Corp., Hatboro, Pennsylvania—$74,580—S/M designing, furnishing and installing Airstream Oscillating System Bldg. #198, Transonic Dynamics Tunnel.

Lance J. Eller, Inc., Keller, Virginia—$63,475—Widening roadway extension and resurfacing old road.

Chicago Bridge and Iron Co., Philadelphia, Pennsylvania—$86,340—S/M for modifying, erecting and testing a vacuum sphere to Bldg. 1251.

LEWIS RESEARCH CENTER, CLEVELAND, OHIO

Westinghouse Electric Corp., Cleveland, Ohio—$75,000—Research study for heating hydrogen gas with an electric arc heater at Lewis.

Jerrold Electronics Corp., Philadelphia, Pennsylvania—$58,924—Installation of a power control and communication pole line at Lewis Research Center.

Harvey Wells Corp., Framingham, Massachusetts—$75,000—Electromagnet and power supply.

Varian Associates Instrument Division, Palo Alto, California—$52,327—Spectrometry system for Lewis Research Center.

Nuclear Development Corp. of America,

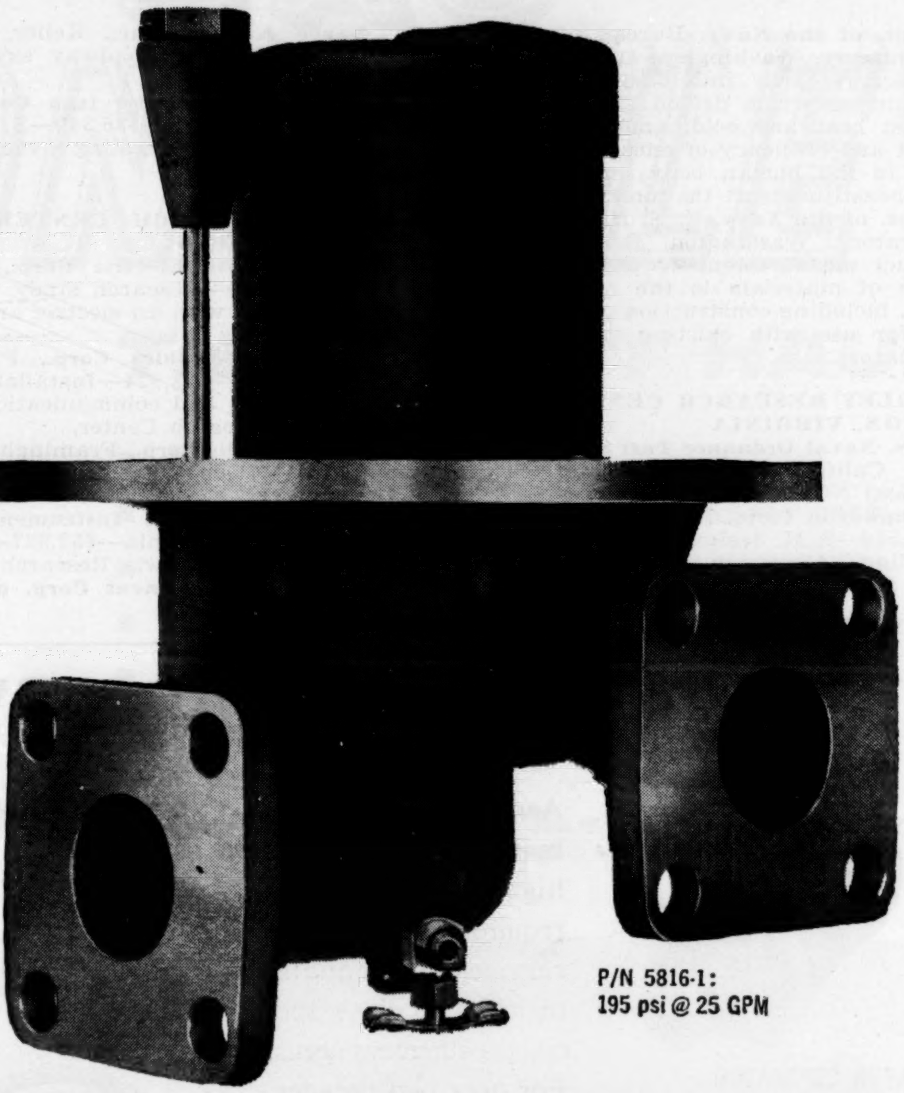
A REPUTATION BUILT ON SERVICE

Aerospace components built by Lavelle meet highest performance requirements. Lavelle services are equally matched to your special procurement needs. For over two decades, Lavelle's policy has been to serve as an integral part of your production team. For prompt delivery of reliable components at reasonable cost . . . rely on a reputation built upon service. Rely on Lavelle.

WRITE FOR BROCHURE DETAILING COMPLETE LAVELLE SERVICES
ENGINEERING • PRODUCTION PLANNING • SHEET METAL FORMING
WELDING • MACHINE SHOP • METAL FINISHING • QUALITY CONTROL

Lavelle

LAVELLE AIRCRAFT CORPORATION • NEWTOWN, BUCKS COUNTY, PA.
Between Philadelphia, Pa., and Trenton, N. J.

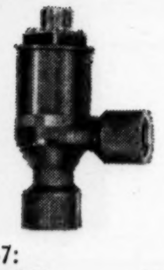

P/N 5816-1:
195 psi @ 25 GPM

FROM TASK—THREE NEW DIELECTRIC COOLANT PUMPS

Three unique design concepts enable Task's FC-75 pumps to realize unprecedented efficiencies for their small size. Exclusive vapor-cooled motor design* provides the simplicity of seal-less construction without incurring viscous and churning losses common to the submerged motor. Hydrodynamic performance is enhanced by utilizing an integral inducer-impeller. A novel internal boost system* assures cavitation-free performance even when reservoir pressure approaches that of the fluid vapor pressure. Combined with sound design and careful manufacture, these innovations result in exceptionally fine pumps.

For further details on Task's dielectric coolant pumps, phone PRospect 4-3100 or write:
Task Corporation, 1009 E. Vermont Ave.,
Anaheim, California

P/N 5792-1:
135 psi @ 7 GPM


P/N 3970-7:
30 psi @ 2 GPM

TASK

*PAT. PEND.

White Plains, New York—$533,445—Liquid metal heat transfer system.

Aerojet-General Corp., Azusa, California—$99,326—Rocket engines.

GODDARD SPACE FLIGHT CENTER, GREENBELT, MARYLAND

Watkins-Johnson Co., Palo Alto, California—$55,291—Ultra low-noise traveling-wave amplifier, solenoid and power supply.

Aerojet-General Corp., Azusa, California—$109,681—Research study to determine propulsion requirement systems for space missions.

Electro-Mechanical Research, Inc., Sarasota, Florida—$93,910—Telemetry encoders for the UK #1 Scout satellite.

Hughes Aircraft Co., Culver City, California—$79,034—Basic research study on avalanche phenomena in semiconductors.

Inland Testing Laboratories, Cook Technological Center, Cook Elec. Co., Morton Grove, Illinois—$50,000—Development of nickel-cadmium storage batteries.

Ampex Instrumentation Products Co., Redwood City, California—$113,175—Three magnetic tape recorder/reproducers.

Rocketdyne Division, North American Aviation, Canoga Park, California—$97,686—Research study to determine propulsion requirement systems for space missions.

National Bureau of Standards, Washington, D. C.—$50,000—Funding to support, in part, the NBS program for the development of radiometric standards in ultraviolet and soft X-ray spectral regions.

MARSHALL SPACE FLIGHT CENTER, HUNTSVILLE, ALABAMA

The Bendix Corp., Teterboro, N. J.—$100,765—Engineering, fabrication services.

Vought Astronautics Division, Chance Vought Corp., Dallas, Texas—$500,000—70 in. containers, oxidizer and fuel for S-1 vehicle (Saturn).

Parker Hannifin Corp., Parker Aircraft Co., Los Angeles, California—$194,487—Research and development of Saturn booster preliminary and fill and drain valves.

Narmco Industries, Inc., San Diego, California—$59,703—Development of adhesives for very low temperature application.

Redstone Arsenal Exchange, Redstone Arsenal, Alabama—$108,000—Contract with Thiokol Chemical Corp. modification to the M-60 rocket motor.

Arnold Air Force Station, Arnold Engineering Development Center, Arnold Air Force Station, Tennessee—$100,000—Provide 5 days of testing time in the propulsion wind tunnel facility to consist of approximately 25 shots at Mach .7-1.5.

Air Products, Inc., Allentown, Pennsylvania — $349,687 — Design, documentation and liaison services for a liquid hydrogen transfer and storage system.

Cryo-Sonics, Inc., Los Angeles, California—$81,427—Unit, pump and vaporized liquid nitrogen, skid mounted—2 each.

Texas Instruments, Inc., Dallas, Texas—$151,800—Amplifiers—200 each.

Trans Sonics, Inc., Lexington, Massachusetts—$56,500—Thermometers.

Convair Astronautics, General Dynamics Corp., San Diego, California—$53,322—Study of orbit-launched vehicles.

Ampex Corp., Atlanta, Georgia—$91,750—Tape Recorder.

Convair Astronautics, General Dynamics Corp., San Diego, California—$80,232—Research and development in prevention of corrosion of metals used in the Saturn.

Chrysler Corp., Missile Division, Detroit, Michigan—$58,492—Investigation of the age deterioration of lubricants subsequent to storage on launch vehicle valves.

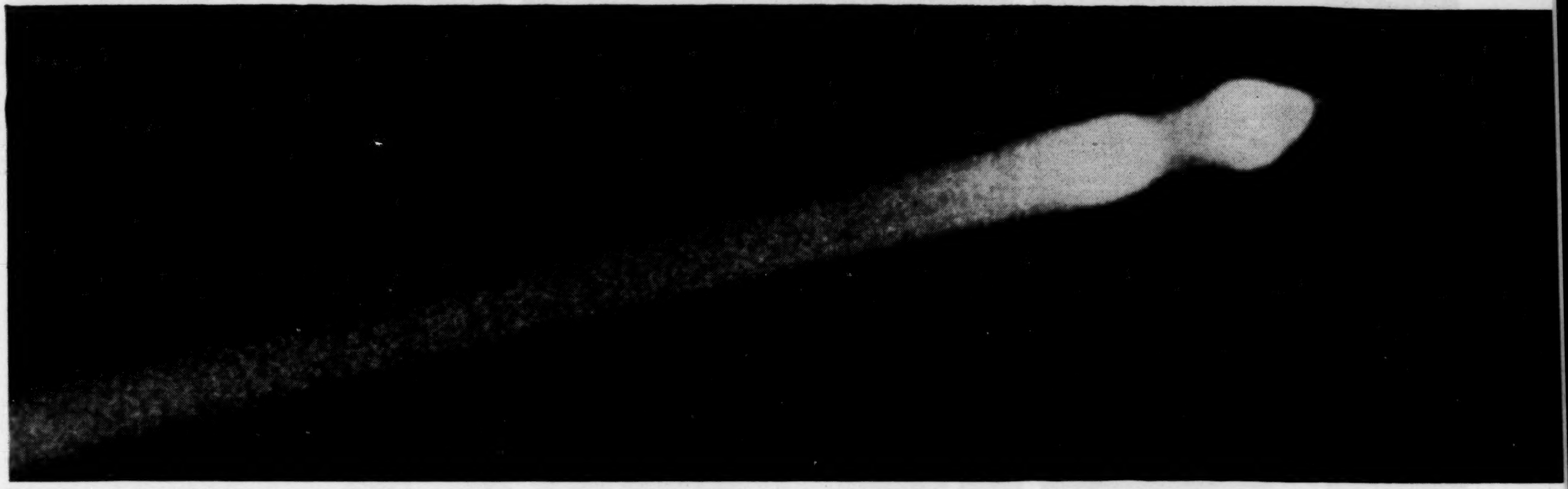
A. E. Burgess Co., Inc., Birmingham, Alabama—$108,333—Paving, grading and drainage for addition to building 4708.

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.—$180,000—Research relative to the development of equipment for acquiring high resolution measurements of wind velocity and vertical wind shear in the troposphere.

LANGLEY RESEARCH CENTER, LANGLEY FIELD, VIRGINIA

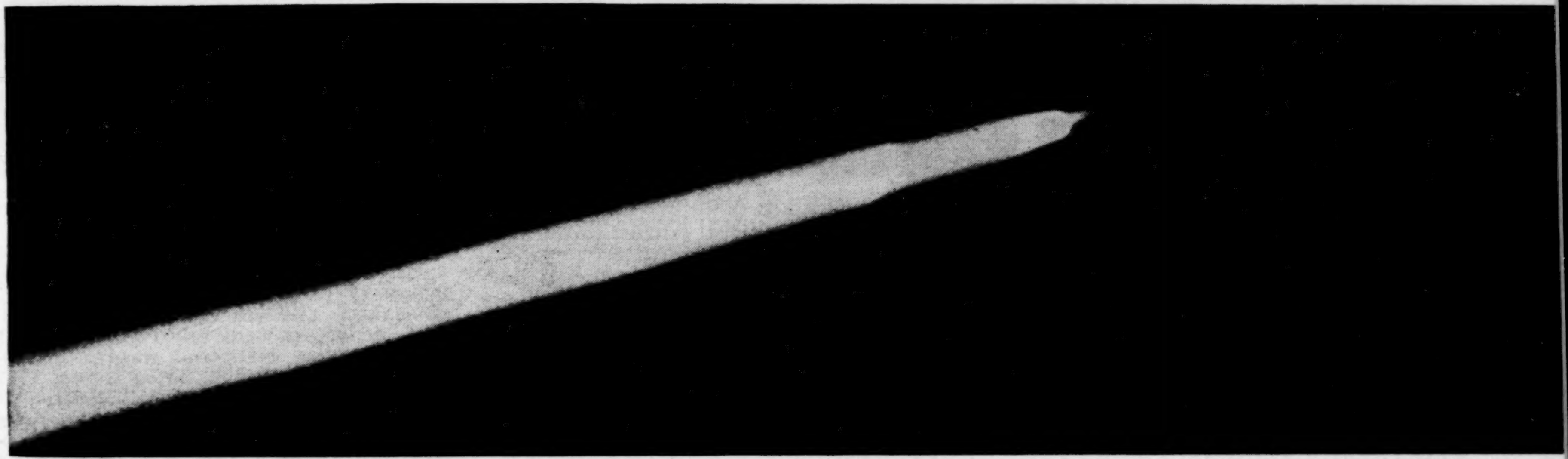
Compudyne Corp., Hatboro, Pennsylvania—$143,080—Designing, furnishing and installing Air Stream Oscillating System, Bldg. 198, Transonic Dynamic Tunnel (L-1473).

North American Aviation, Downey, California—$80,000—Two Little Joe airframes.



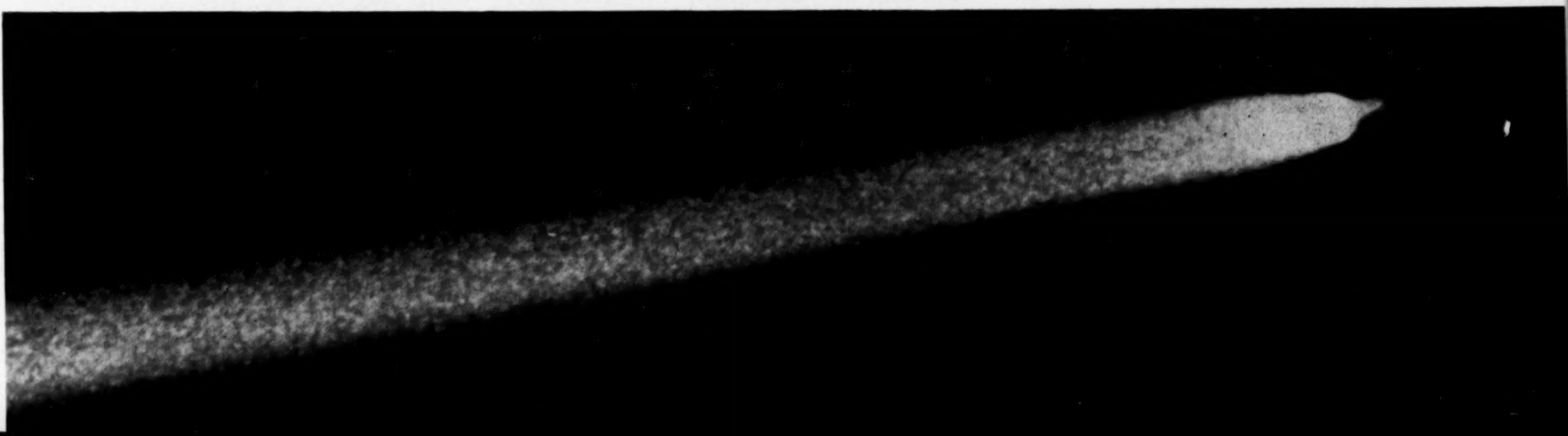
Ignition of USAF Minuteman ICBM second stage, as separation from first-stage engine begins, initiates the sequence.

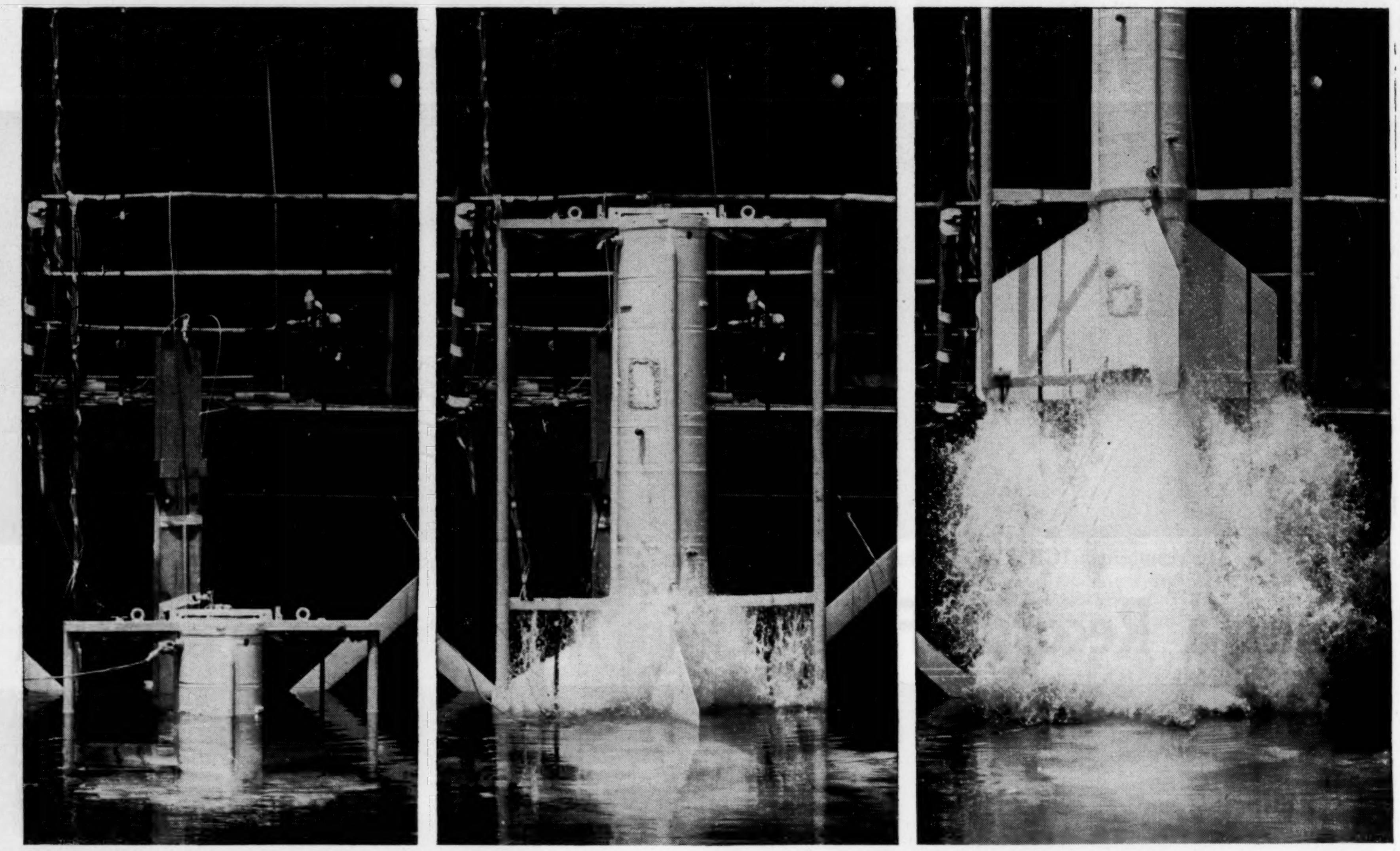
Camera Records First Stage Minuteman Separation



Aerojet-General Corp.'s second-stage engine of the three stage missile takes over as first stage falls away.

First-stage Minuteman motor is shown tumbling earthward (top), caught in the exhaust of the second stage. Pictures were filmed with a 70 mm. Perkin-Elmer Roti camera. In final photo (bottom), second stage, having completed its separation, continues on its flight path.





UNDERWATER LAUNCH of Aerobee Junior begins (left) with top of missile case showing above surface of water in flooded flame bucket. Center, missile rises up guidance cables after underwater ignition. Right, exhaust thrust is visible through spray.

Aerobee Junior Fired In Underwater Test

Azusa, Calif.—Liquid-fueled Aerobee Junior rocket has been successfully started underwater in a test at the Aerojet-General Corp. facility here of the much-proposed open sea launch concept.

Aerojet claims it was the first underwater launch of a liquid propellant rocket. The 10-ft. rocket was mounted in a framework and allowed to rise along a pair of vertical cables to height of 30 ft. where it was halted by a tether. A flame-bucket on one of the Aerojet test stands was flooded to serve as a test basin for the experiment. The rocket and test rig floated in 25 ft. of water. At ignition, the nozzle was at a depth of about 9 ft. and about 10 in. of the front end was visible above the surface.

The firing was the first of a series of tests which will include free-flight launchings from the open sea. These are expected to begin off Pt. Mugu, Calif. within a few weeks. Pacific Missile Range will provide support. Range personnel have conducted similar tests with solid propellant rockets. The captive launch at Azusa was part of a company-funded program to measure the feasibility of sea launching liquid propellant rockets and acquire the technique of doing it. The Aerobee Junior has been successfully started underwater in a number of static firings and ignition has been found to be reliable. The program is under the supervision of Capt. Robert C. Truax USN (ret.), director of Advanced Development for the Aerojet Liquid Rocket plant.

In the captive launch test, the rocket was held vertical in the water before launch by a heavy steel ballast drum hung from the tail. The ballast was separated from the rocket at ignition. The propellants burned were JP-4 and inhibited red fuming nitric acid, a hypergolic combination. The rocket developed 2,600 lb. thrust. All access doors of the rocket were sealed watertight to protect interior components.

USAF Contracts

Following is a list of unclassified contracts for $25,000 and over as released by U. S. Air Force contracting offices.

HEADQUARTERS, AERONAUTICAL SYSTEMS DIVISION (ASKPMG) WRIGHT-PATTERSON AFB, OHIO.

Aero-Dox Construction Co., Detroit, Mich., dismantle one type MB-2 aircraft maintenance dock at Homestead AFB, Fla., and re-erecting one each at Tulsa Municipal Airport, Tulsa, Okla., (re-erection items include existing or new sheeting and insulation, miscellaneous items plus allied construction), IFB 33-600-61-217, contract AF 33(600)43001, dated June 9, 1961, $152,699.

Air Logistics Corp., Pasadena, Calif., type A/S48A-1 wheel drive unit, hydraulic, aircraft propelling. Letter contract AF 33 (600)42989, dated May 5, 1961, $800,000.

Lockheed Aircraft Corp., Marietta, Ga., materials and services relative to a C-130B flight simulator, tests and reports, supplemental agreement No. 6, dated May 4, 1961, to contract AF 33(600)40997, $57,956.

Mast Development Co., Davenport, Iowa, IFB 33-600-61-178, contract AF 33(600) 43382, dated June 9, 1961, 145 sets, $69,043.

R & D Constructors, Inc., Detroit, Mich., dismantle twelve each type 130 foot span government owned aircraft maintenance docks at Tulsa Municipal Airport, Okla., and re-erect components supplemented by new materials in a configuration to cover a 180,000 square foot area at Davis-Monthan AFB, Ariz. Contract AF 33(600) 42998, dated June 1, 1961, $567,500.

Weston Instruments Division, Daystrom Inc., Newark, N. J., Indicators, ID-426A/ ARN, FSN 6605-611-8237, aerno 81-3376, spare parts, aerospace ground equipment and data. (aircraft usage B-58A installations and spares), letter contract AF 33 (600)42653, dated Feb. 23, 1961, 86 ea., $13,500.

Astronics Division, Lear, Inc., Santa Monica, Calif., varying quantities of components of flight control subsystem target aircraft type A/37G-3 for Q2-C aircraft. Letter contract AF 33-(600)42788, dated Mar. 28, 1961, $1,000,000.

The Firestone Tire & Rubber Co., Akron, Ohio, tires, tubeless, pneumatic, aircraft, size 36 x 11 ply rating, FSN 2620-555-2266, aerno 41-8566. (replenishment spare for F-105 aircraft.) Contract AF 33(600)43439, dated May 23, 1961, 5240 ea., $700,326.

Sundstrand Aviation Division, Sundstrand Corp., Rockford, Ill., acquire and install machine tools, supplemental agreement No. 1, dated May 5, 1961, to contract AF 33(600) 42241, $504,879.

The Morse Instrument Co., Hudson, Ohio, type EH-8A photographic film processing machine. Contract AF 33-(600)43433, dated May 23, 1951, 10 ea., $172,028.

Apparatus Division, Texas Instruments Inc., Dallas, Texas, aircraft multi-sensor display console, spare parts, engineering services and data. Contract AF 33(600) 43470, dated May 25, 1961, 1 ea., $284,443.

FINANCIAL

Texas Instruments Reports Profit Decrease Despite Sales Upsurge

Decrease in earnings despite an increase in sales, influenced largely by substantial competition in pricing in the semiconductor field, is noted by Texas Instruments, Inc., executives in revealing financial results of the Dallas, Tex., company's three- and six-month financial periods (AW July 12, p. 73).

Sales billed for the six months ended June 30 totaled $119,860,000 and net earnings were $6,374,000, equal to $1.60 per common share, compared with sales of $116,051,000 and net earnings of $7,921,000 or $2 per share for the same period last year. In the three months ended June 30, the firm experienced sales of $60,883,000 and net earnings of $2,601,000, equaling 65 cents per share compared with sales of $59,853,000 and net earnings of $3,991,000 or $1.01 per share for the same three months of 1960.

Board Chairman J. E. Jonsson and President P. E. Haggerty now estimate that Texas Instruments' 1961 sales and earnings will fall in the area of the low end of forecasts made in April. Haggerty felt then that sales would reach an all-time high level for the company of between $240 million and $270 million for the year, with earnings ranging from $3.50 to $4 per share of common—indications are now that billings for the year will probably approximate $240 million and net earnings are not expected to reach the $3.50 minimum forecast and could possibly fall to $3.

Any marked upswing in the company's business in the short term must come as a result of expanded military programs, they noted, and although the company has received some requests to increase its production schedules for defense equipment and components, its executives feel that the full effects of the speed-up in U. S. defense spending will not be felt until 1962. A lower third quarter than the same period last year is being conservatively expected, with fourth quarter showing more strength.

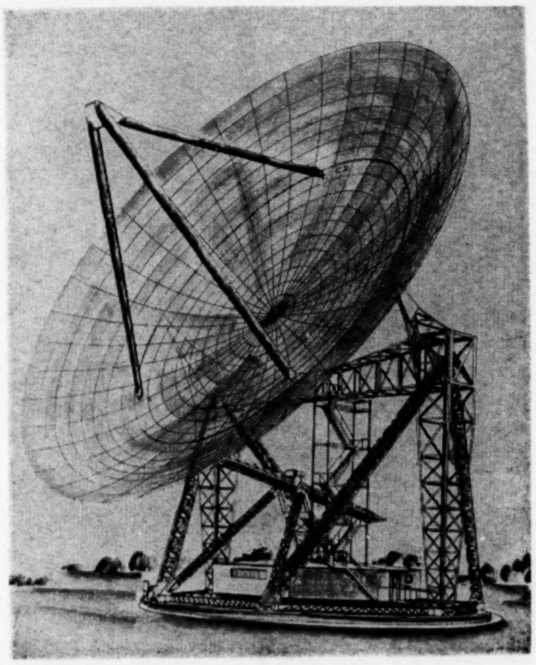
Company officers noted that $35 million will be spent in 1961 by the firm on research and engineering programs, of which approximately 50% is supported by outside agencies, primarily the military.

Decline in the company's geophysical exploration sales has been more than offset by what is termed a rapidly developing market for applications of the geosciences to defense needs—notably its receipt of eight contracts totaling more than $5 million in Project Vela Uniform, which is studying means of identifying and monitoring underground nuclear explosions. In the study phases of this program since its start, the company is now a principal contractor in its systems development.

Texas Instruments' manufacturing backlog as of June 30 was $93.7 million, up slightly from the end of last year. Government business totaled $37.2 million of this backlog.

Other electronics firms generally reported upward trends in both sales and earnings:

- **Thompson Ramo Wooldridge, Inc.**, reported increased sales and a rise in operating earnings during the second quarter of 1961, but financial results for the period were dominated by substantial losses incurred by a subsidiary, Pacific Semiconductors, Inc. A reappraisal of PSI's inventories resulted in a write down of approximately $3 million, which affected TRW's earnings for the quarter. Sales totaled $104.2 million during the second quarter of 1961 as compared with $96.7 million in the first quarter and $107.5 million in the second quarter of 1960. Adjusted net income for the second quarter of 1961, including provision for inventory reappraisal, was $581,300 or 15 cents per share. Net income for a similar period of 1960 was $2,671,582 or 82 cents per share. Officials estimated that total sales for the year would reach $400 million.



Radar Telescope

Nation's largest radar telescope, expected to go into operation late this year, will use most powerful transmitter ever built to operate in the 20 to 60 mc. frequency range, according to Continental Electronics Manufacturing Co., a Ling-Temco-Vought subsidiary, which is producing the equipment. The $1.5-million facility, to be operated by Stanford University and Stanford Research Institute, will use a 150-ft. parabolic steerable antenna, the largest in the U. S. and believed to be the world's second largest.

- **Hoffman Electronics Corp.'s** net sales for the first six months of 1961 amounted to $31,336,996, an increase of $7,401,446 over the comparable period in 1960. Net earnings for the first half of 1961 amounted to $349,657 or 22 cents per share. During the first half of 1960, net earnings were $123,054 or eight cents per share.
- **Lear, Inc.**, reported operating earnings of $1,410,961 for the first half of 1961, a 14% increase over the $1,235,307 earned during the first six months of 1960. Per share earnings totaled 51 cents in 1961 and 46 cents in 1960. Total income in the first half of 1961 was $2,121,182 or 77 cents per share, compared with $2,011,098 or 75 cents per share in a similar period of 1960.
- **Ling-Temco Electronics, Inc.,** reported sales of $70,847,881 for the six months ended June 30 and net income of $827,379, equal to 32 cents per share. This compares with sales of $76,120,306 and profits of $1,437,076 or 59 cents per share for the similar period last year. President James J. Ling attributes phaseout of the Corvus air-to-surface missile, canceled last year by the Navy, as a major factor in the sales and earnings decline. Corvus contributed $14,730,000 in sales and $600,000 in profits during the first half of 1960.

Financial Briefs

United Aircraft Corp. earnings for the first six months of 1961 were slightly less than half the amount earned in the same period last year, due mainly to "an adverse relationship of costs to selling prices on certain production contracts, both military and commercial," H. M. Horner, chairman, and William P. Gwinn, president, told stockholders. Net profit for the 1961 first half was $5,001,879 or 67 cents a share on shipments of $565,722,520 compared with a 1960 first-half profit of $10,040,759 or $1.46 a share on shipments of $543,227,294.

Grumman Aircraft Engineering Corp. first-half sales gained over the 1960 first-half figure, but comparable earnings declined. For the six months ended June 30 Grumman profit was $3,036,796 or $1.38 a share on sales of $155,810,185 compared with 1960 first-half income of $4,125,365 or $1.88 a share on sales of $154,071,814. Com-

BENDIX COUNTDOWN FOR SPACE

7

PNEUMATIC CONTROLS: Hot gas equipment is being developed for space control subsystems using rotary and linear actuation, reaction jets, and pneumatic computation. A complete subsystem is now being built at E-P under USAF contract.

6

SELF-ADAPTIVE CONTROL SYSTEM: Capable of measuring dynamic sensitivities and adjusting feedback gains in stable fashion without sensing external environment. Automatically blends control of aerodynamic surfaces and reaction jets. Being developed under USAF contract.

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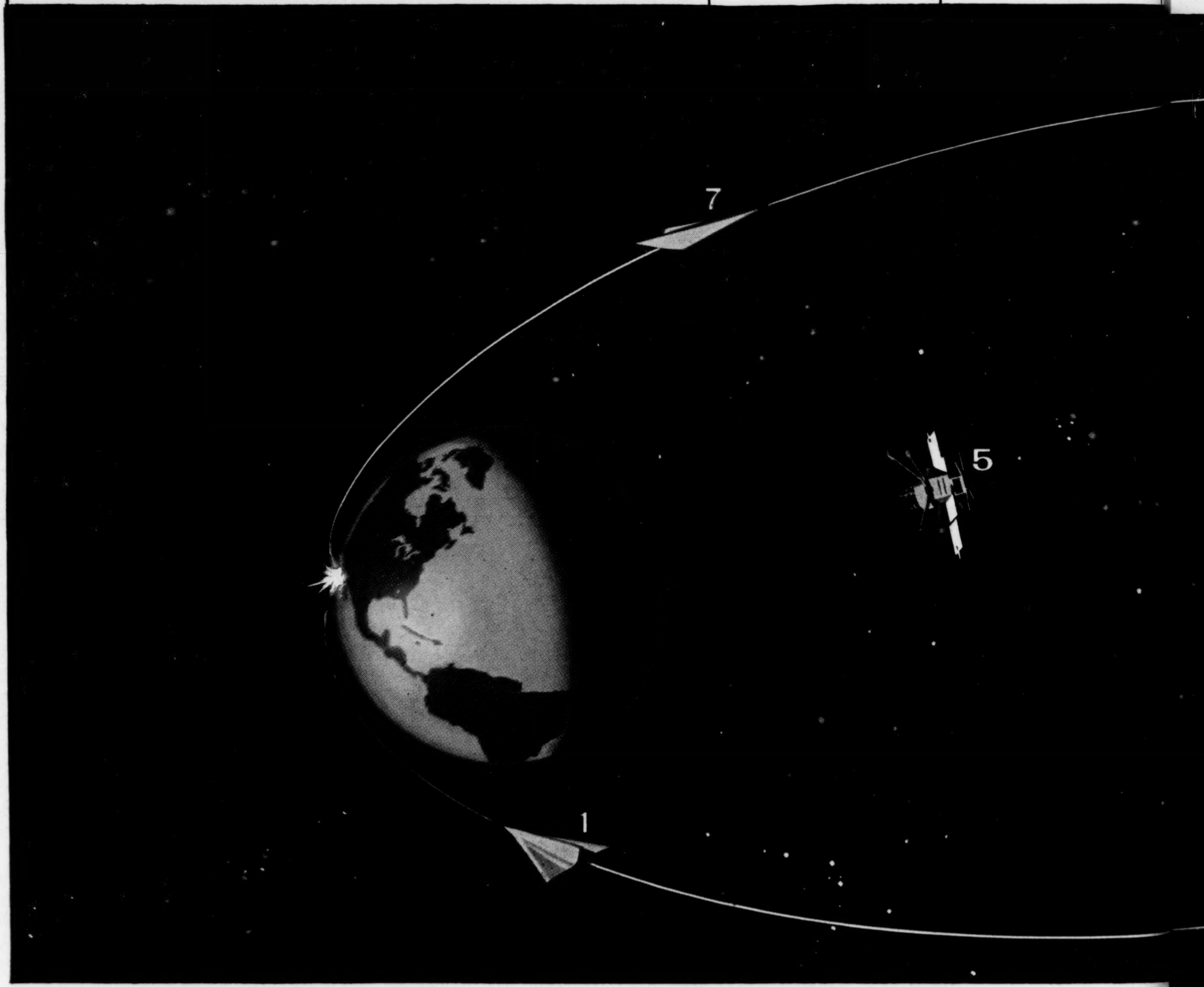

Knowmanship in Action

Technical knowledge, management ability, and craftsmanship all add up to Eclipse-Pioneer's space-age Knowmanship. We pride ourselves on anticipating our customers' needs—and meeting them with technical advancements based on specific requirements. The manufacture of precise components and total subsystem capability are typical of our creative ability as a major contributor to the field of space technology. By applying principles of Knowmanship, we're able to

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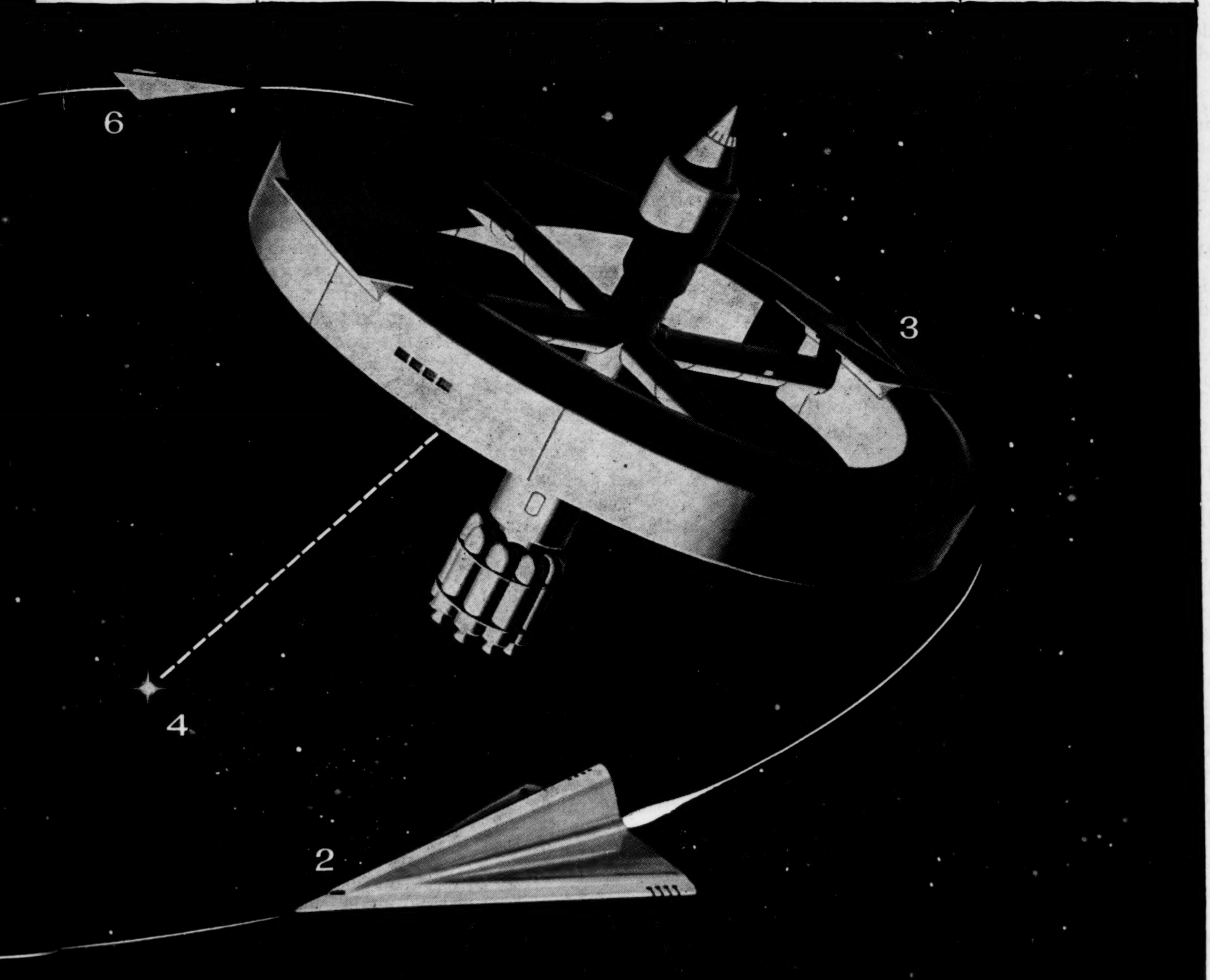
SATELLITE CONTROL AND STABILIZATION: Eclipse-Pioneer has total in-house capability for producing spacecraft attitude-control systems. In production: ADVENT reaction wheels. In development: sun-sensors and star trackers.

STAR TRACKER SYSTEM: A system incorporating multiple star tracking heads, designed to operate without a protective dome in the environment of space; digital readout accuracy of ±5 arc seconds.

SPACECRAFT RENDEZVOUS COMPUTER: Complete solid-state mechanization for analog and digital airborne computation of navigation, guidance, and altitude-control circuitry required at time of rendezvous. Digital computation at 10 megacycle rate.

ADVANCED DISPLAYS AND CONTROLS: Development currently in progress. Human-factor display studies directed toward rendezvous, re-entry, energy-management. Electronic and optical devices will present correlated data with minimum panel space.

LETDOWN, APPROACH, LANDING: Safer, more reliable letdown and landing systems—such as inertially augmented flare and runway-alignment, computers, advanced instrumentation (including real-time displays)—are now being developed, flight-tested.



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able to + SPECIALIZED CRAFTSMANSHIP = **KNOWMANSHIP**

Eclipse-Pioneer Division
TETERBORO, N.J.

THE Bendix CORPORATION

pany funding of research and development programs pulled down net earnings, Grumman said. Backlog of orders on June 30 was $275 million; it was $315 million the year previous.

Chance Vought Corp., Dallas, Tex., net income for six months ended June 30 totaled $1,541,263 or $1.21 per share, on sales of $91,280,271, compared with a net income of $1,563,644 or $1.24 per share on total sales of $114,893,302 for the same period the year previous. Chance Vought President Gifford K. Johnson noted that a reduction of $600,000 in accrued federal income taxes applicable to 1960 partially offset by a provision of $356,500, net of taxes, for impairment of investment in an unconsolidated subsidiary, has been reflected in the six months statement. A 34-cent dividend has been declared payable Aug. 22 to holders of record on Aug. 7—the dividend covering only July and August, two thirds of the normal dividend period, since Aug. 31 is established as the closing date for sale of assets of the corporation to Ling-Temco Electronics, Inc., in the merger agreement between the two companies.

New Offerings

Hi-Shear Corp, Torrance, Calif., engaged in the design, development and manufacture of high strength and close tolerance fastening devices and fastener assembly systems for the aircraft and missile industries. Offering is 139,500 common shares; 105,000 shares for public sale by the company, and 34,500 outstanding shares by the present holders. Of the company's proceeds, $200,000 will be applied to discharge short-term bank loans; $300,000 to construct two new buildings for engineering and laboratory work and research, development and processing of exotic metals for use in its products.

Applied Research, Inc., Port Washington, N. Y., engaged in the design, development, manufacture and sale of devices, systems and subsystems used in connection with space and earth communications, radio frequency analysis, missiles and satellites, and radar and telemetry systems. Offering is 120,000 shares of common stock; 60,000 shares for public sale at $6 per share by the company, and 60,000 outstanding shares by the present holders thereof. Proceeds of the company's sale will be used for leasehold improvements and for additional production machinery and test equipment; the balance for general corporate purposes as required.

Douglas Microwave Co., Inc., Mount Vernon, N. Y.; the company and its subsidiaries are engaged in design, manufacture and sale of microwave components, test equipment and subsystems as well as research and development in the field of microwave energy. Offering is 100,000 shares of common, for public sale on an all or none basis; public offering price and underwriting terms to be supplied by amendment. Proceeds will be used to repay bank obligations incurred for working capital purposes; for research and development; for increased advertising; for additional equipment and machinery; the balance will be added to the company's general funds, and will be used for development and production of "sophisticated" and "end-use" microwave units and, as required, for working capital purposes such as raw material purchases and payment of trade accounts and the like.

Washington Engineering Services Company, Inc., Bethesda, Md., offers a variety of services for engineering professions and manufacturing companies which are provided on a project basis and include a Systems Maintenance Program, Documentation Systems Program, Training and Training Materials Program, and Instruction Manuals Program. Offering is 375,000 shares of common stock, for public sale at $1 per share. Proceeds will be used for leasehold improvements; to pay existing bank and other notes payable; as working capital to be used to pay employe compensation during a 30- to 90-day time interval between the time the company performs work on its various contracts and the time that it receives payment therefor.

Airtronics International Corporation of Florida, Fort Lauderdale, Fla., engaged primarily in the manufacture of electronic, mechanical and electromechanical rocket and missile system parts and components under subcontracts with United States Government contractors, and government contracts involving electrical and machine work. Offering is 199,000 shares of common stock; 110,000 shares for public sale by the company, and 89,000 outstanding shares by the present holders thereof. Offering will be made on an all or none basis; public offering price and underwriting terms to be supplied by amendment. Proceeds of the company's sale will be used to repay advances from factors; to prepay 15% notes payable; the balance will be added to general funds and will be available to pay a portion of the cost of constructing, equipping and furnishing the proposed extension of the company's plant. Any remainder will be used as working capital.

National Semiconductor Corp., Danbury, Conn.; organized under Delaware law in 1959, the company has been in the development stage for the greater part of its existence, having been in commercial production since the fall of 1960. It is engaged in the design, development, manufacture and sale of quality transistors for military and industrial use. Offering is 75,000 shares of capital stock for public sale; public offering price and underwriting terms to be supplied by amendment. Offering also includes: 172,500 capital shares to be sold to officers and employes upon exercise of options granted or to be granted under the company's Employes' Restricted Stock Option Plan; 15,000 capital shares for subscription by officers and employes under its Employes' Stock Purchase Plan; 210,085 capital shares to be issued upon conversion of outstanding 6% convertible subordinated notes. Proceeds will be used for the acquisition of capital equipment for production and test; for improvements to leased production facilities; for working capital requirements to expand inventories; the balance for general corporate purposes, principally the augmentation of R&D staff and equipment.

Eastern Air Devices, Inc., Dover, N. H., engaged in the production of power components and servo components, including servo motors and tachometers. Offering is 150,000 shares of common stock for subscription at $5 per share by common stockholders of Crescent Petroleum Corp., its parent, at the rate of one company share for each 10 Crescent shares held; record date and underwriting terms to be supplied by amendment. Of the proceeds, $675,000 will be used to meet the company's obligation incurred in the purchase of certain machinery and equipment which had been under lease to the company; the balance for general corporate purposes.

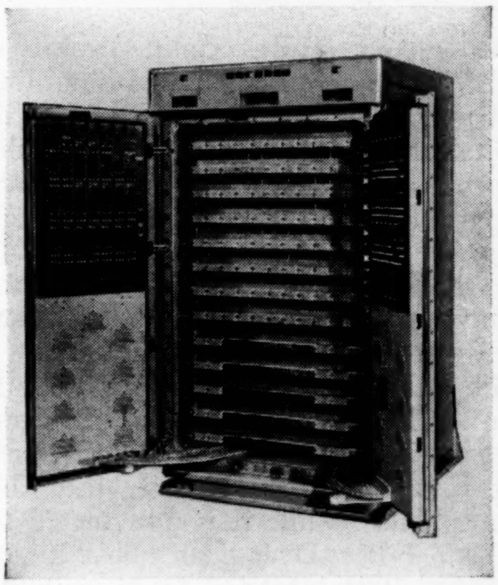
Pacific Air Lines, Inc., San Francisco, Calif., engaged in the air transportation of passengers, property and mail, serving 30 cities through 25 airports in the states of California, Nevada and Oregon. Offering is $1,800,000 of 6½% convertible subordinated debentures, due 1976, and 180,000 shares of common stock for public sale in units, each consisting of $100 of debentures and 10 common shares; public offering price and underwriting terms to be supplied by amendment. Proceeds will be used to pay certain accounts payable incurred in connection with the purchase of new aircraft, spare engines and parts, the modernizing and remodeling of aircraft, and installation of radar equipment; the balance will be added to general funds and used as working capital and for general corporate purposes.

Keeping a firm grip on the system

NTDS (Naval Tactical Data System) is the Navy's new tactical defense system in which UNIVAC® was a major contributor. Specifically, UNIVAC designed the system and also designed, developed and produce the computers and related periphral equipments. It finds approaching targets, calculates their course and speed, evaluates other tactical information, and recommends courses of action . . . all in practically "zero" time so that effective defensive measures can be taken. It ties an entire task force together in a vast network of instant data processing communications . . . lets the task force commander control his tremendous firepower as if it were all on one ship.

NTDS represents two major advances. Its computer is the first military real time computer . . . AN/USQ-20 (UNIVAC 1206 Military Real Time Computer). It completes complex calculations so rapidly that time lapse has to be measured in millionths of a second. In addition, the UNIVAC 1206 and all NTDS hardware is built to military environmental specifications (MIL-E-16400) so as to operate with a high degree of reliability under the most adverse shipboard conditions.

Much of the success of NTDS is the result of the comprehensive systems management program developed by UNIVAC. This program coordinates all phases of research, design and development, and manufacturing . . . and includes a parallel program of reliability engineering to assure operational reliability, beginning with the first delivery, that meets or exceeds all specifications.



The Univac 1206 (AN/USQ-20) Military Real Time Computer —a stored program computer that emphasizes random-access memory and ease of communication with a wide variety of peripheral equipment. It is *ruggedized* and thus makes possible many new shipboard, airborne, and mobile applications.

First in command and control systems . . .

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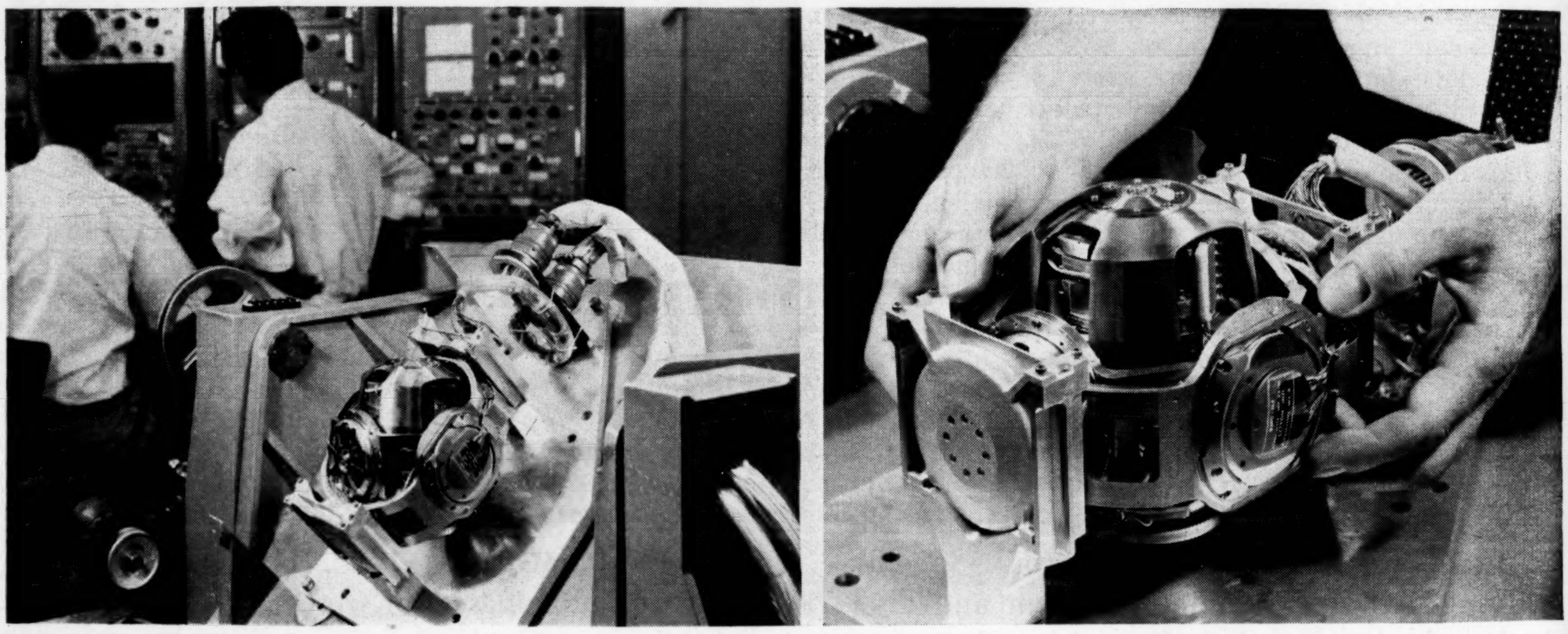
AVIONICS



INERTIAL PLATFORM developed by Litton Systems for Air Force-sponsored investigation of suitable flight data system for advanced re-entry vehicles is shown on flipping fixture, left, and in closeup, right. Stable element (gyro and accelerometer package) isolated from vehicle angular motions by a four gimbal system, enables the unit to provide a measurement of vehicle acceleration and attitude with respect to desired coordinate system. The platform weighs 15 lb., and is a smaller, modified version of another model scheduled for use in many Canadian and European Lockheed F-104 interceptors (AW Jan. 9, p. 81).

Litton Is Developing Space Data System

By Barry Miller

Woodland Hills, Calif.—Prototype flight data system capable of obtaining and providing data for control of earth orbital aerospace vehicles is being developed here by Litton Systems, Inc., as part of an Air Force applied research program. The program seeks to establish the feasibility of integrated instrumentation and control systems using both inertial and aerodynamic data.

The system may be employed in both manned and unmanned high-performance vehicles capable of flight through, exit from, and then re-entry into the atmosphere. While it is not related to the Air Force Dyna-Soar boost glider program, it is intended to be suitable for future aerospace vehicles, among them possibly follow-on versions of Dyna-Soar and the Air Force's projected Aerospace Plane.

A major part of the current Air Force-Litton effort revolves about obtaining data during all phases of vehicle flight, including the securing of aerodynamic data during re-entry. These data, along with inertial system outputs, can be processed in the system's computer which would supply command signals and flight data for automatic vehicle control and/or visual display.

Typical operational envelope for a vehicle employing this system would involve altitudes of 1 million ft. or greater, velocities up to 26,000 fps. and temperatures which would be encountered during shallow angle re-entry.

Although the program, sponsored by the Flight Control Laboratory of USAF's Aeronautical Systems Division (ASD), is concerned primarily with new techniques, not an operating system, a rather rough form of a prototype system is being assembled here. In part it will be only a breadboard version. Other parts, such as a lightweight inertial platform, as can be seen in accompanying photographs, are sufficiently well developed to approach operating models. Litton's current contract, initiated in 1959, will expire late this year.

Flight Data System

The flight data system will provide necessary outputs for the advanced Mark IV orbital bomber cockpit (AW Aug. 8, 1960, p. 32) being developed for ASD by Lear, Inc. The two systems began as separate programs, were then brought together to be sure the data system satisfies the requirement's of the cockpit displays.

Significant anticipated features of the flight data system, according to ASD technical people directing the program, are:

- **Integrated Systems Concept**—System will use both inertial and aerodynamic data; also, accept inputs from ancillary sensors such as Doppler radar, radio navaids automatic data link and optical monitoring devices.
- **Inertial Reference Unit**—This includes a 15-lb. inertial platform, a miniaturized and modified version of an inertial platform scheduled for use in many European Lockheed F-104 interceptors.
- **Air Data Probe**—Simple, self-contained nose probe which theoretically would operate through speeds in excess of Mach 20 and contemplated re-entry corridors. The probe will contain necessary transducers and instrumentation for measuring such quantities as indicated local pressure, total pressure, temperature, indicated angle of attack, indicated angle of yaw and the body axis acceleration components.

When processed in a flight data system computer included in the system, indicated airspeed, pressure altitude, Mach number, true airspeed, true angles of attack and sideslip can be derived during re-entry. Funds from the current Air Force contract will carry this phase of the program only through design studies.

The system is intended to be operative through varying phases of flight including launch, climb and exit from atmosphere, injection into orbit, orbit, de-orbit, re-entry, approach and landing.

Working on the program, as subcontractors to Litton, are:

- **Fairchild Camera & Instrument Corp.**—Air data subsystem.
- **Cornell Aeronautical Laboratory**—Analytical studies for instrumentation transducers.
- **Dodco, Inc.**—Trajectory analysis and energy management re-entry schemes.
- **Kistler Instrument Corp.**—Special instruments.

The flight data system comprises three major subsystems—an inertial data sensor assembly (including the inertial platform), air and remote data sensor assembly (to be made possible with the nose probe) and a flight data computer.

Inertia data sensor assembly, built around the 15-lb. inertial reference unit, includes platform electronics, digital converter and a signal adapter. The complete assembly, Litton says, will weigh less than 40 lb.

The reference unit provides measurements of vehicle acceleration and attitude with respect to a desired coordinate system.

Within the reference unit is the stable element employing two floated, two-degree-of-freedom gyros and three floated torque balance accelerometers supported by a set of gimbals which permit vehicle angular freedom in azimuth, pitch and roll.

Orientation Procedure

Orientation of the stable element is maintained by properly torquing the gimbals and gyros. Angular error signals derived from the gyro pickoffs torque the gimbals to maintain the inertially fixed orientation. The gyros are torqued to properly precess so as to hold the desired inertial orientation. A redundant inner-roll gimbal prevents gimbal lock, allowing complete vehicle maneuverability without disturbing the stable element.

Before a working model of the 15-lb. unit was built, Litton unsuccessfully proposed the concept in a guidance competition for the Dyna-Soar late last year. It hopes for better results now that it can demonstrate working hardware.

Occupying about ¼ cubic ft., the Litton platform (P-300) has been under test since Apr. 1. It can achieve and probably better a required 50 deg./sec. flip rate.

Gimbal diameters are about 6 in., not counting the outer roll end mounts, while the lateral length of the platform was held to about 6½ in.

Reductions in platform size, Litton engineers say, were achieved through the use of smaller gyroscopes with more convenient form factors which in turn enabled gimbal size to be shrunk. Pancake electro-mechanical elements were employed in making the device more compact.

The company's development of gas bearing gyros, not originally part of the program, will assist it. In the present model, ball bearing gyros are employed. These meet the Air Force's specifications of random drift rates of less than 0.01 deg. per hour. The random drift rate specification for gas bearing gyros which would replace them is 0.005 deg. per hour. This is a respectable drift rate figure for operational equipment although it is somewhat higher than figures frequently quoted for more exotic and more remote electrostatic, cryogenic and nuclear gyros.

A first design of a gas-bearing gyro for this platform is now being assembled. A larger model, suitable for the platform employed in the F-104 is operating.

Platform Development

One goal of the platform development, according to Litton, was to make it and its components readily accessible for maintenance. The stable element, company engineers say, can be removed easily in minutes. Similarly, assembly of the platform was simplified and the way was opened for a low-cost inertial system.

Power required by the reference unit is 25 watts plus 100 watts for heater power.

The electronics unit needs 180 watts plus heater power.

Servo amplifiers for controlling gimbals and accelerometers, power supplies and additional circuitry are in the electronics unit. The digital converter converts analog accelerometer outputs into digital data for the flight data system computer and also supplies precision torquing pulses for the gyros on command from the flight data computer. The signal adapter will adapt gimbal angle output signals to the requirements of other subsystems or remote equipment.

Both Litton and civilian Air Force technical personnel directing the program are reluctant to discuss details of the air and remote data sensor assembly—particularly the heart of the assembly—the air data probe, largely, they say, because the techniques, while theoretically sound, must still be proven.

The assembly will consist of a blunted cone, aerodynamic nose probe, completely self-contained. In it will be a simple cooling system, various transducers and associated electronics. The probe provides a means of measuring air data during re-entry, from which other variables such as indicated airspeed, Mach number, etc., can be computed in the flight data system computer.

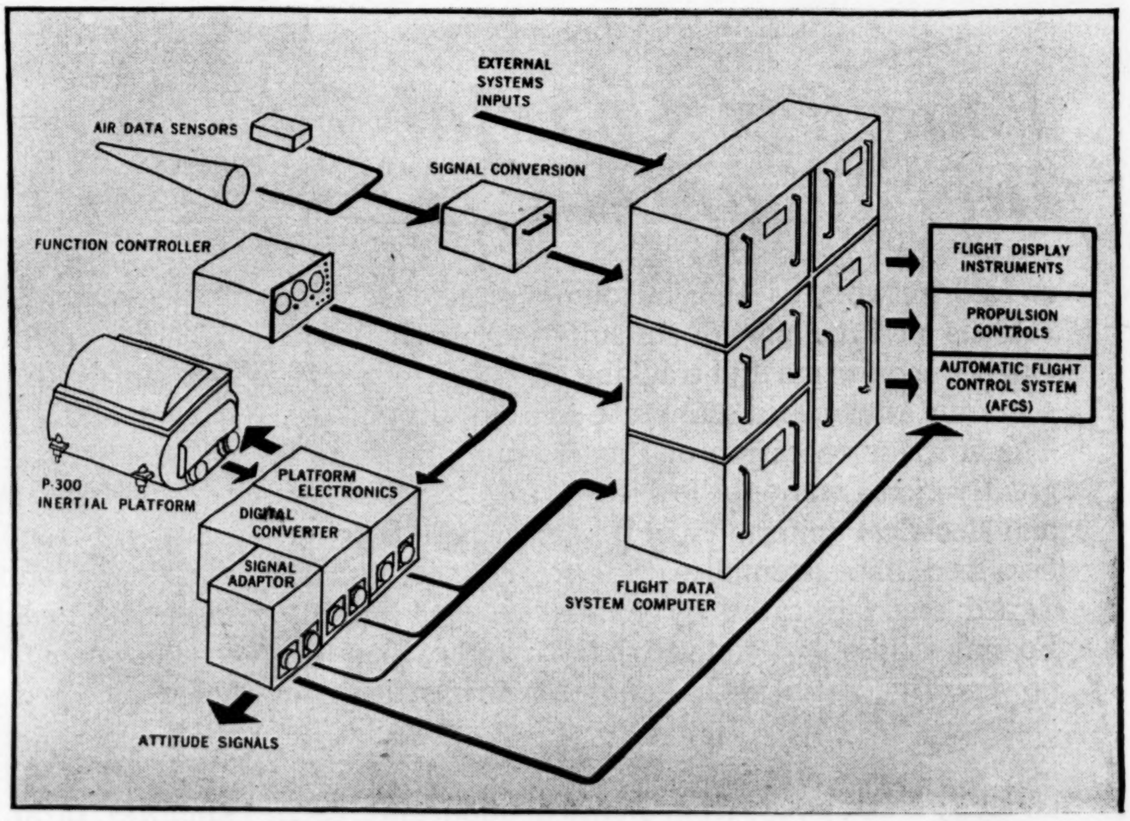
The five-foot nose probe will weigh about 40 lb. and contain instrument packages with tubes to the ports in the probe. New types of transducers will be employed because of the need for devices capable of functioning at extremely low pressures. Some sensors will be located on the probe surface.

Probe Cooling

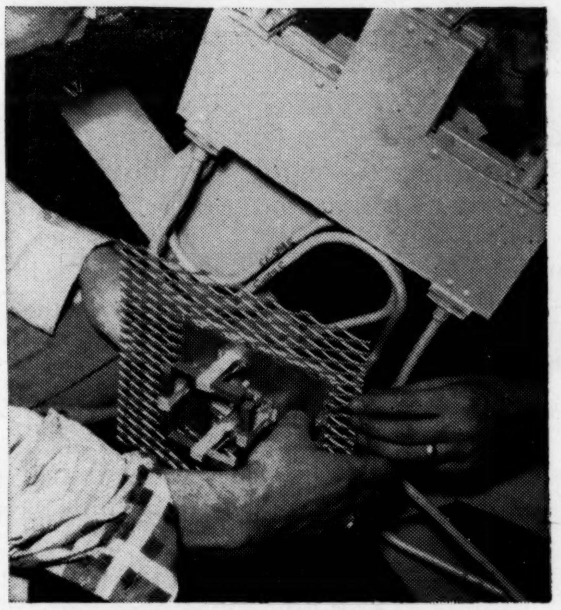
Cooling of the probe made necessary by high temperatures on re-entry is achieved through sublimation. Solid material near the nose of the probe will be sublimed to a gas and the heat removed to the sides at the rear of the probe by a pressure self feed.

Litton presently is engaged in heat input tests to determine the rate of gas removal and will run detailed calibration of the probe shape. The company has selected suitable materials preparatory to arriving at a mechanically suitable design.

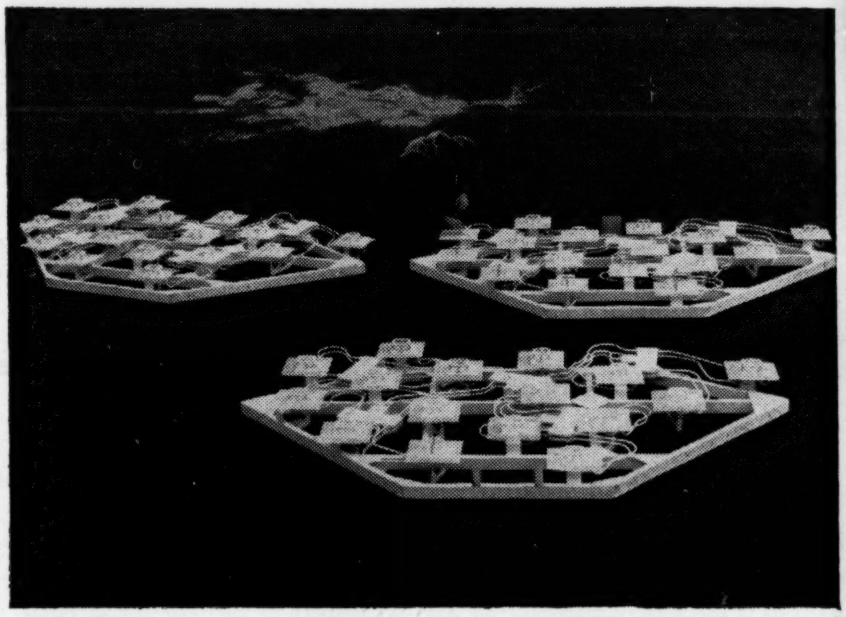
After each use, it is expected that the probe can be reserviced by placing



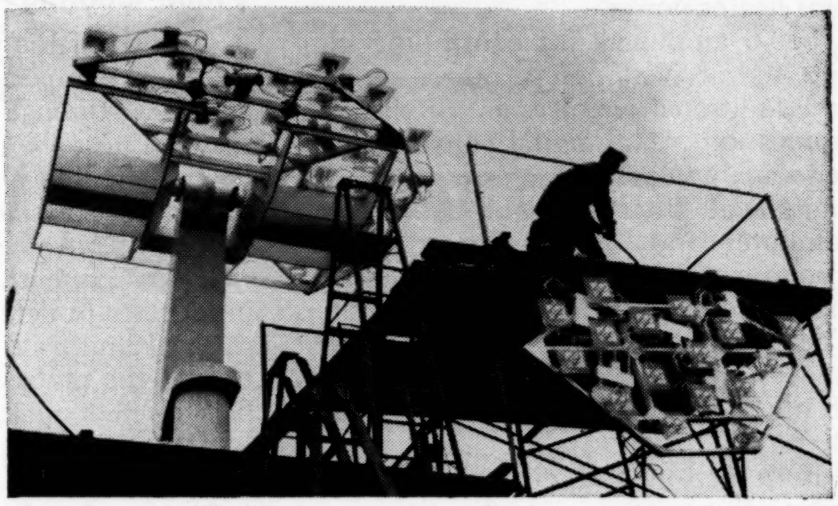
FLIGHT DATA SYSTEM will use inertial and aerodynamic data, process them into command signals and flight data for automatic control and/or visual display. Aerodynamic data will be obtained during re-entry by cone-shaped nose probe containing necessary sensors. Elements of the prototype system represented here are in varying stages of completion at Litton Systems. Mating cockpit display is being developed by Lear, Inc.



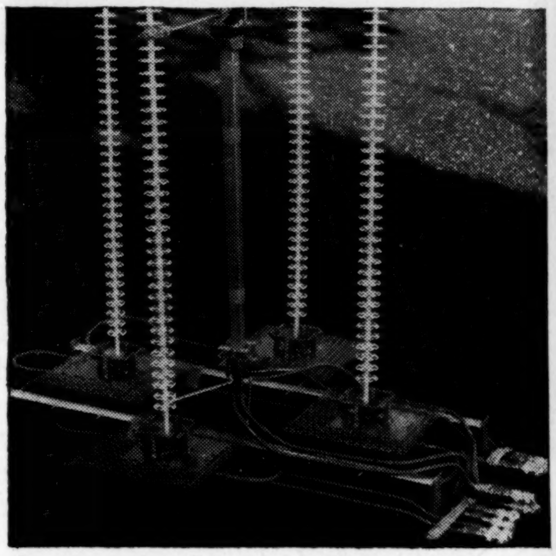
Individual unit assembly is first step in construction of antenna. Here four dipole antennas mounted on ground screen are being connected to one end of Foamflex feed lines. Special Phelps Dodge connectors are used to link the lines to the dipoles and four-way power dividers.



Completed quadrant elements, ready for placement on pedestal mount. Each quadrant is pre-assembled in exactly the same manner.



Completed quadrant elements are raised to platform for placing into position on pedestal mount.



An example of a center element unit that can be inserted into the Avien-Bogner array. This element forms a separate unit that can also be used as a portable ultra high frequency antenna.

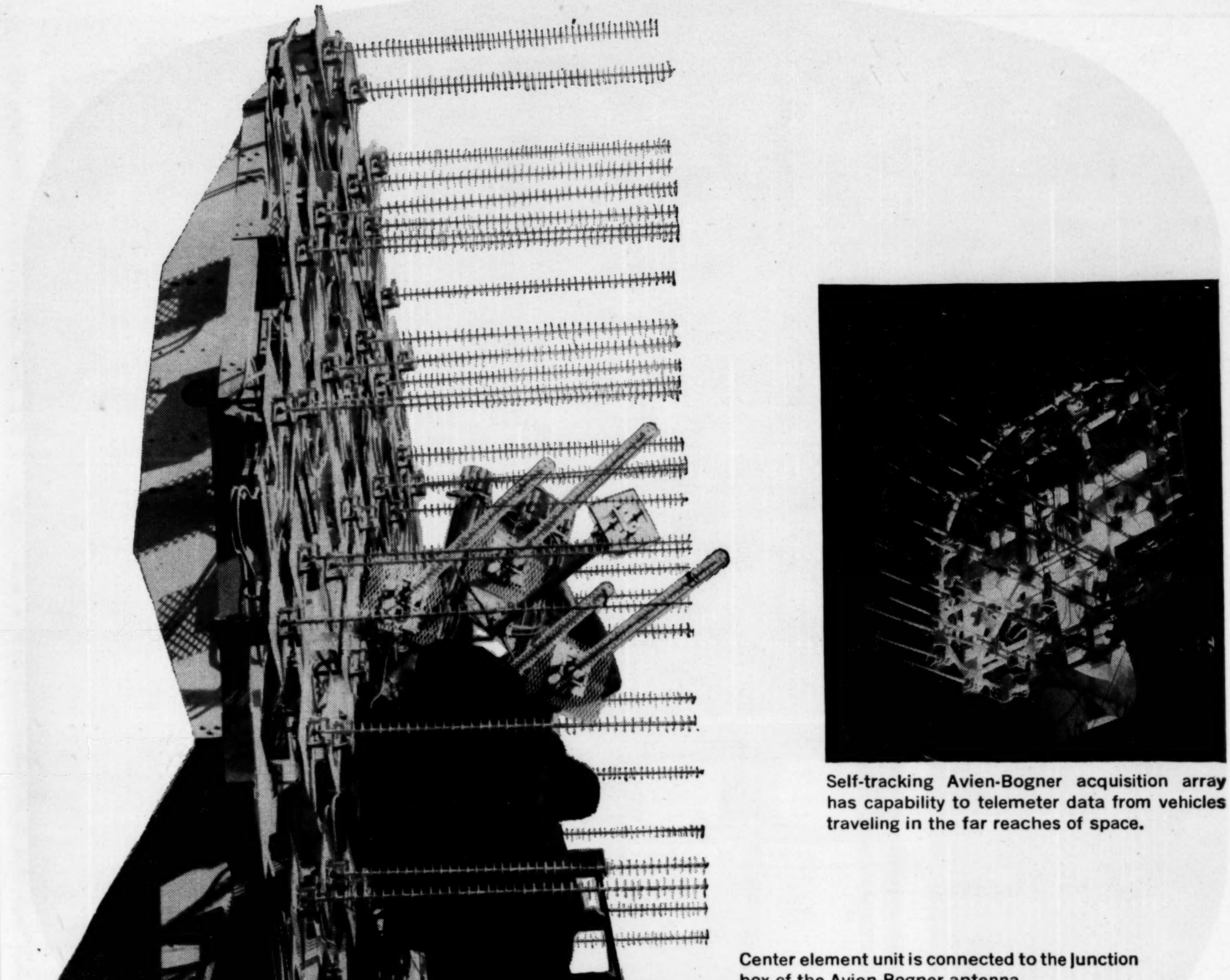
Foamflex® Coaxial Cable helps put and keep this advanced antenna system on the track!

A feed network of 3/8", 50 ohm Foamflex coaxial cable is a critical part of the fully automatic Avien-Bogner acquisition and tracking antenna that represents an advance in the state of the antenna art. The efficient operation of this sensitive antenna is greatly increased by the low loss, high phase stability and electrical uniformity of its weatherproof Foamflex feed line assemblies. Special connectors, designed and fabricated by Phelps Dodge, link the Foamflex lines to double-tuned, strip-line, four-way power dividers in each quadrant element of the antenna.

Designed for Edwards Air Force Base, this modular array is assembled from identical quadrants, each equipped with power dividers, dipole antennas and cigar elements. In contrast to the heavier, fixed-type paraboloids, the lighter, smaller Avien-Bogner model costs less, yet has high acquisition capability for telemetry information through the use of three automatic tracking modes. Quadrant elements may easily be replaced when changes are desired in frequency bands, due to the simple design and construction of this antenna.

The feed system was planned, fabricated, calibrated and installed by A-T Electronics, New Haven, Conn. Accurate uniformity of electrical length for each cable was maintained from cable to cable within one degree at 2200 megacycles after bending.

The outstanding qualities of semi-flexible, aluminum-sheathed Foamflex have been proved in a number of applications where low loss, long operating life and a low noise to high signal level ratio are essential. If your specifications call for a coaxial cable of the highest efficiency, we recommend you investigate the capabilities of Foamflex.



Self-tracking Avien-Bogner acquisition array has capability to telemeter data from vehicles traveling in the far reaches of space.

Center element unit is connected to the junction box of the Avien-Bogner antenna.

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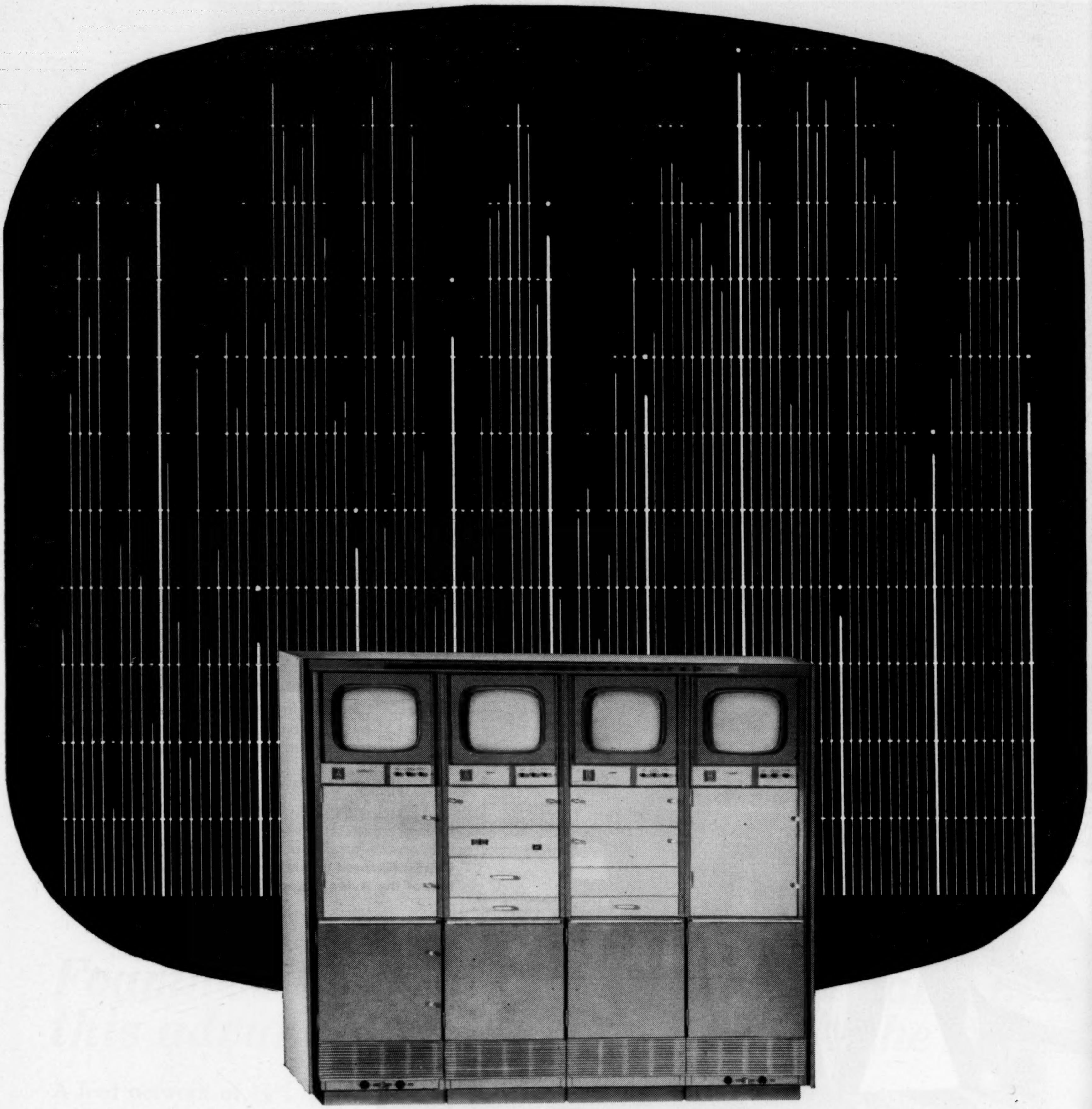

THEY RELY ON RADIATION
to place preflight data on display

This Raster Display System gives *Minuteman's* test crew instant visual display of vital data during missile checkout. Its bar graph presentation of such variables as temperature, pressure and acceleration provides a quick indication of total system performance.

Radiation met the design challenge presented by Raster with an entirely new state-of-the-art approach to real time display. The system can present up to 400 channels of PCM data for visual interpretation with an accuracy greater than ± 1%. In addition, a decommutator and patch panel permits programming of incoming information to required CRT's.

The Raster Display System illustrates Radiation's unique capability for design and packaging of advanced electronic systems. It also marks a significant contribution to display systems for military and industrial applications. To learn how Radiation can help solve your advanced electronic problems, write for our "Capabilities Report." Radiation Incorporated, Dept. AW-8, Melbourne, Fla.

All qualified applicants will receive consideration for employment without regard to race, creed, color, or national origin.

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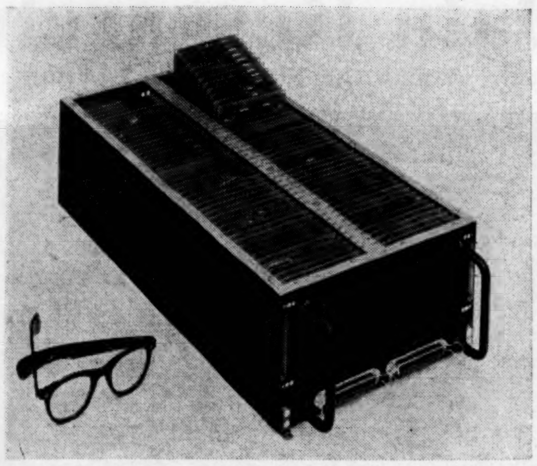


ARITHMETIC UNIT of the Litton flight data system computer shows circuit card construction. Welded wire matrix construction is expected to cut weight and size of operational equipment.

a fresh stock of the subliming material in the nose.

Among the advantages of the probe are:

- **Backup for re-entry control.**
- **Research tool.**
- **Provide more accurate** measurement of some quantities during re-entry than can be inferred from an inertial system.

The flight data system computer is a combination general purpose computer and a digital differential analyzer. The general purpose portion performs its operations through central commands and data taken from a 256-word magnetic core memory. A magnetic drum device is backup storage for commands and constants. Two-way communication between core and drum memories is executed in parallel with computation. Arithmetic computations are performed in a parallel mode.

The computer, for which logical design and the core memory have been completed, is expected to weight about 65 lb.

This represents a reduction by a factor of 2½ from projected size using conventional packaging techniques. Litton would achieve the diminution with its own version of welded wire matrix packaging.

Computer drum storage is 8,000 words, word time about 57 micro-seconds and total storage of the magnetic core memory is 256 words. The memory drum has been run, and heads installed.

Working with inputs from the inertial system and the air data sensor assembly, the flight system computer calculates air data, flight director information, barometric inertial coupling, gyro precession commands and general command functions for presentation to flight display instruments, propulsion controls and automatic flight control system.

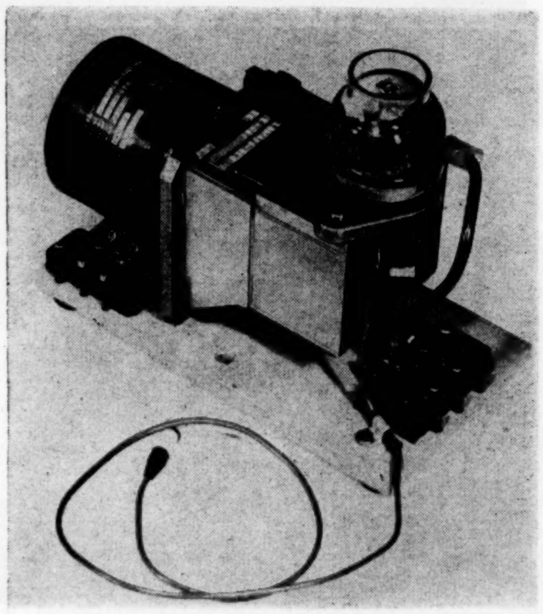
In addition, the computer system can accept inputs from auxiliary sensors such as Doppler radar, radio navaids and optical devices.

NEW AVIONIC PRODUCTS

- **High-power diplexer,** Model FUU-401, designed for 800 to 1,000 mc. can provide high isolation between high-power transmitter and a receiver operating on the same antenna system. Isolation of 120 db. can be obtained with receiver pass band loss of 0.3 db. Transmitter arm of the diplexer has insertion loss of less than 0.1 db. Pass bandwidths are about 20 mc. Manufacturer: Rantec Corp., Calabasas, Calif.

- **High-power transistors,** Types 2N1015, 2N1015A, 2N1015B, 2N1016, 2N1016A and 2N1016B, are 150 watt, single-ended stud types with collector-emitter voltages of 100 volts, minimum beta of 10 at 5 amps. These transistors are suitable for applications in power converters, power supply regulators, d.c. and servo amplifiers and as replacements for relays. Manufacturer: Silicon Transistor Corp., Carle Place, N.Y.

- **Thermoelectric infrared cooler,** which can achieve temperatures down to −78C to −90C, consists of an infrared detector cell mounted on a four-stage cascaded thermoelectric cooler installed within a vacuum enclosure. Heat rejected at hot junction is dissipated by fan and heat exchanger. Cascaded thermoelectric junctions can cool 15 milliwatt load to −78C when used with heat sink at 27C. Manufacturer: Pesco Products Division, Borg-Warner Corp., 24700 No. Miles Blvd., Bedford, Ohio.



- **Code convertor,** Model 770, can accept binary code characters up to six bits in any combination and convert each character into equivalent character in any other binary code arrangement for applications in code conversion, character recognition or generation. Unit is priced at $4,100 and can be delivered in 60 days. Manufacturer: Electronic Engineering Co., 1601 E. Chestnut Ave., Santa Ana, Calif.

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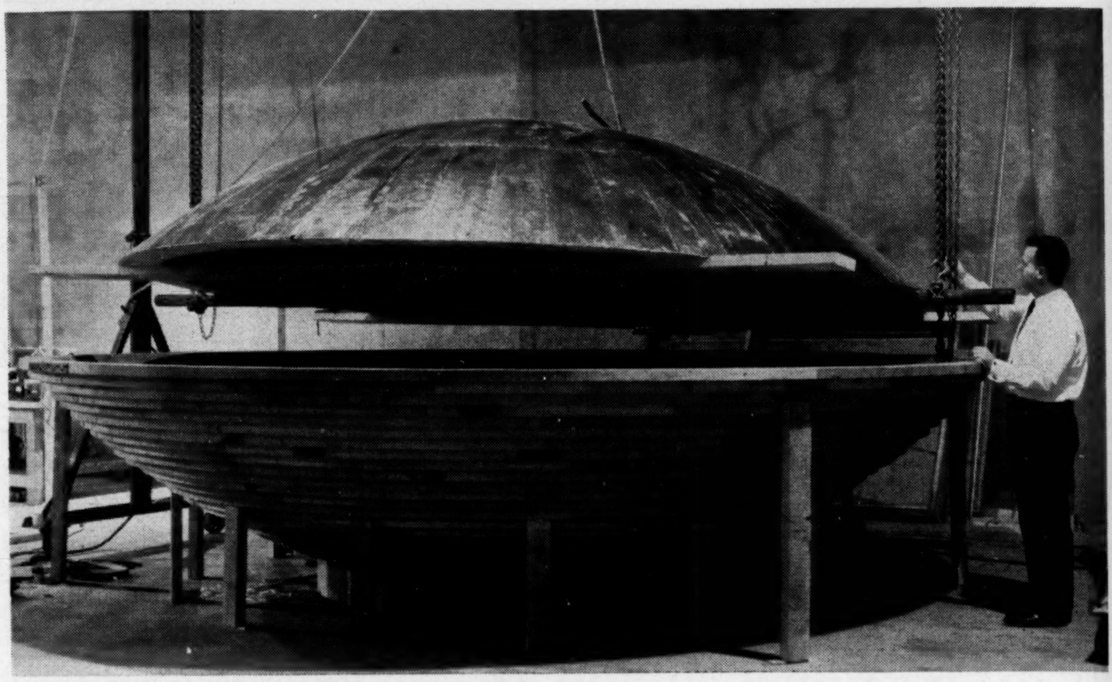
Models Aid Earth Current Data Research

Glendale, Calif—Modeling techniques which will enable scientists to answer questions about vulnerability to enemy jamming and reliability of hardened communications systems are being studied here as part of Space-General Corp.'s continuing interest in long-range, low-frequency "earth current" communications systems.

By combining a few well-known liquids, such as salt water or alcohol, with materials such as brass screen or expanded polystyrene, the company is simulating in the laboratory the effects of ionospheric irregularities and geological heterogeneities on possible earth current communications systems.

Space-General, through its predecessor, Space Electronics Corp. (which combined with Aerojet's Spacecraft Division earlier this summer), demonstrated two years ago (AW May 18, 1959, p. 26) the feasibility of an earth current technique which will be employed for the Minuteman ICBM launch control system. Since then, it has pursued its research and field tests with earth current systems under various Air Force contracts.

In effect, Space-General is scaling the earth and its surrounding media to a size conveniently realized in laboratory models. Measurements can be performed in a 10- or 15-day period at a cost not exceeding $15,000 that otherwise might require field tests conducted in different seasons, at day and during the night, at costs of several hundred thousand dollars.



SPHERICAL EARTH MODEL to be used in laboratory investigation of earth current communication system by Space-General Corp., shows copper-coated earth surface, which reproduces earth conductivity. The earth model will be inverted and then placed in a bowl where both air and ionospheric conditions will be simulated.

SAMPLE HOLDER is filled with test fluid to simulate physical media whose electrical characteristics affect electromagnetic propagation of earth current communication system.

Modeling Techniques

Using modeling techniques, the company has made measurements of radiation patterns and determined the effects of implanting radiating and receiving elements at different earth depths. It has made measurements of gain versus depth below the surface, gain versus number of elements in an antenna array as well as radiator impedance and radiation pattern measurements.

Reducing actual physical parameters by factors of thousands or millions and yet reproducing conductivity dielectric constant, and permeability characteristic of each layer of earth, the air or ionosphere in the laboratory gives scientists a chance to see how reliable buried techniques of electromagnetic radiation are, how susceptible they are to jamming. They can then "go into" reproduced hostile territory to determine how effectively and economically each system can be jammed.

Different geological levels of the earth, air and ionosphere under different conditions are reproduced in effect by materials whose electromagnetic parameters are identical to those of the simulated medium.

Such modeling techniques are valid, the company points out, so long as two relations are true for every medium. These are that the real and imaginary parts of the square of the product of propagation constant and linear distance between earth and current transmitter and receiver are equal to their respective counterparts for the model.

One of these two equalities states that the product of the actual transmitting frequency, conductivity, permeability and square of the linear distance must equal the same factors in the model case. This permits the relatively long actual distance over which the system is intended to operate to be scaled to a reasonable laboratory dimension by picking a frequency for the model that is much higher than the actual frequency of the system under investigation.

The model frequency is the main variable that can be juggled in these equalities in recreating different media and their electromagnetic properties. Once model conditions are realized, quantitative measurements of the effects of differing conditions on electromagnetic wave propagation can be determined. Space-General's interest is in systems operating below 200 kc.

Since it is necessary to select higher frequencies in the model than in actual case to offset the smaller linear distances employed in the laboratory, availability of high frequency sources imposes minimum limits on the size of a model.

For a typical model, the operating frequency range of a system, the physical site where it is to be located and the mode of earth current system are first selected. This selection establishes electrical parameters which would be characteristic of the media in the selected location. The dimensions of a particular model would be fixed in a trade-off of dimensions and frequency sources.

One model built by the company consists of a half-hemisphere, 20-ft. in diameter, and made of laminated white pine. Its convex surface simulates the earth's surface and is covered with copper foil to reproduce the high conductivity of the earth. This model constitutes a 2 million-to-1 scale reduction.

Expanded polystyrene is cemented to the copper to simulate the air space between the earth's surface and the ionosphere. The "earth" is inverted, convex side down, and placed within a 21-ft.-dia. bowl of nearly pure alcohol to scale ionospheric conductivity.

A groove is routed into the earth's surface and a tube inserted as a track for a receiving probe which samples signal level as range from the transmitter is varied continuously.

A system's vulnerability to jamming both from high-power sources in hostile territory and smaller possible sources of local saboteurs can be determined.

The term "earth current" has been the subject of disagreement over a precise definition. By "earth currents," Space-General refers to any system in which the receiving and transmitting antennas are buried within the earth. Hence, the definition would encompass several modes of operation including long- and short-distance surface waves and direct waves. A surface wave is an electromagnetic wave which travels from the radiating source to the surface, along the interface between the earth and the air and down to the receiving antenna. For reasonable distances the ionosphere does not affect the surface waves but at longer distances it does. The direct wave, as its name implies, travels directly through the earth, preferably through a low-conductivity layer, to a receiving antenna. One suitable layer is the granite region which at times is 5,000 to 8,000 ft. below the earth's surface, while at other points is only several hundred feet in depth.

The company's modeling techniques were supported by Air Force's Rome Air Development Center.

PROBLEMATICAL RECREATIONS 81

The sum of the digits on the odometer in my car (which reads up to 99999.9 miles) has never been higher than it is now, but it was the same 900 miles ago. How many miles must I drive before it is higher than it is now. *—Contributed*

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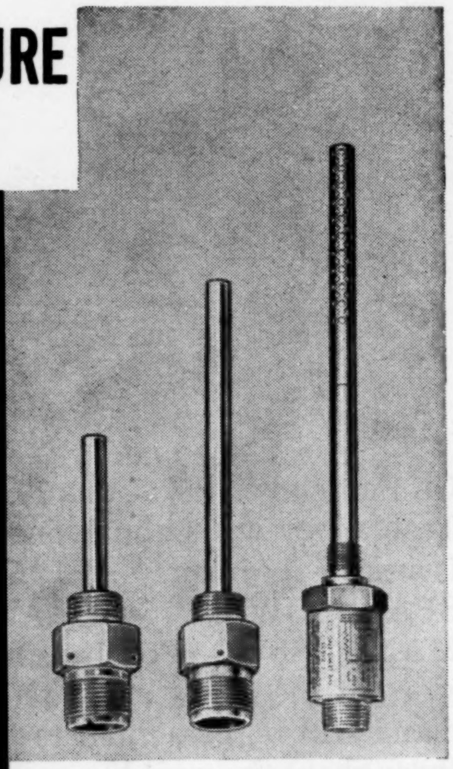

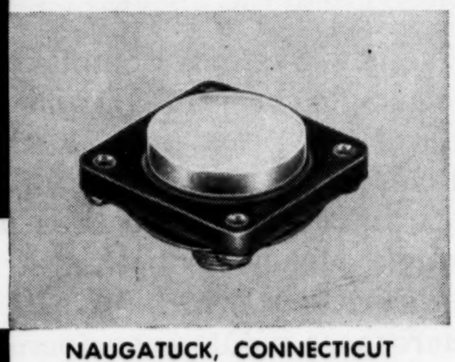

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On September 25, AVIATION WEEK and Space Technology will publish one of the most important issues in its history . . . "FORGING MILITARY SPACEPOWER" – USAF SYSTEMS COMMAND ISSUE. For the first time, the complete story of the newly activated USAF Systems Command will be presented to the aerospace industry throughout the world.

The new Systems Command will serve as a single agency to control R&D and procurement of all aircraft, missile, avionic and space systems for the USAF from the idea stage through the time they are in the field ready for use. This concept of a single agency for both systems R&D and systems procurement will have penetrating impact on all aerospace industry companies selling hardware or research services to the Air Force.

The Systems Command will control approximately $15 billion in contracts and annually will award $7-8 billion in new contracts making it the most important single source of aerospace industry business. Further evidence of the impact on industry are policy and procedure changes which can be expected in many areas such as technical approach, contract competition, proposals, cost estimating, management structure and subcontracting.

These are just a few of the important details to be covered in the Systems Command Issue, which will constitute a new handbook in doing business with the Air Force. Teams of AVIATION WEEK editors are now visiting the various bases of the Command for full, complete reports. Detailed edi-

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USAF SYSTEMS COMMAND ISSUE

SEPTEMBER 25, 1961

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Raytheon Designs Machine That Learns

By Philip J. Klass

Learning-machine which has been used to design radar target discrimination filters, and a more advanced machine now under development which is expected to be able to learn to recognize speech sounds, have been revealed by Raytheon Co.

The new machine, called the Cybertron, performs somewhat in the manner of the Cornell Aeronautical Laboratory Perceptron (AW July 4, 1960, p. 72.), but differs considerably in its operating principles and construction.

The first of the Raytheon Cybertrons, known as the K100, currently is being used for undisclosed military problems under Defense Department contract. The larger, more advanced K200, now in final stage of development, is expected to be able to recognize spoken words and to generate outputs for operating an electric typewriter to type out the spoken word with phonetic spelling, the company says.

Both the K100 and K200 employ conventional digital computer circuit elements in their construction, and digital computer types of memory. The K100 uses punched tape, while the K200 will employ a magnetic drum memory.

This feature, which distinguishes the Cybertron from the early Perceptrons, makes it possible for "knowledge" acquired by the Cybertron during its learning process to be quickly and conveniently transferred to a smaller, less complex machine, which Raytheon calls AIDE (Adapted Identification Decision Equipment). AIDE lacks the learning ability of the Cybertron, but uses the Cybertron's acquired knowledge to perform routine discrimination tasks, Raytheon says.

Like the Perceptron, the new machine learns initially from a human instructor. For example, if the problem is to analyze a sonar recording and discriminate between a submarine and spurious targets (such as whales), a sonar recording known to be a submarine is fed to the Cybertron where its spectral analysis is stored in the machine's memory.

Then a different sonar recording, whose source is known to the human instructor, is fed to the Cybertron and the machine is "asked" to identify it as a submarine or spurious target. If the machine makes the correct identification, the human instructor takes no action. If the machine is wrong, the instructor pushes a "goof button" which causes the Cybertron to modify its memory.

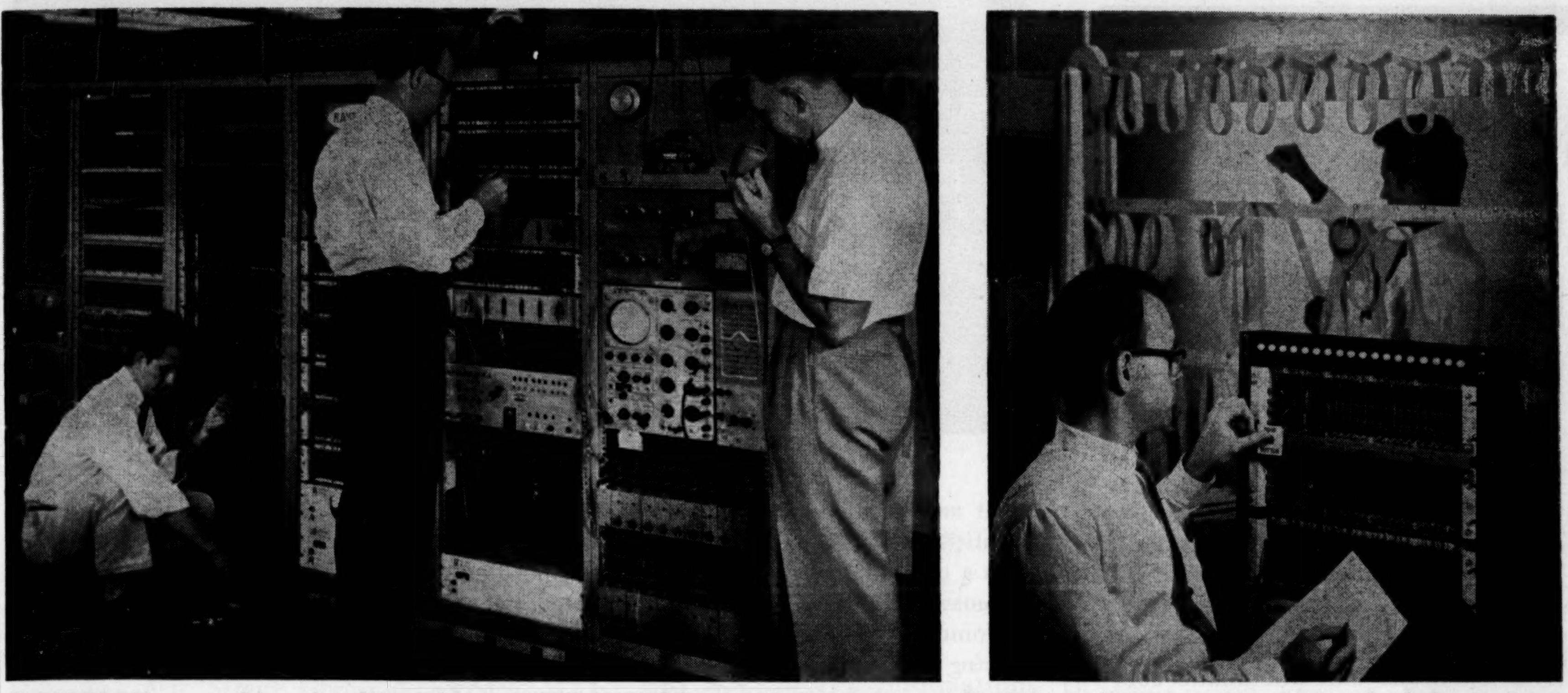
After a suitable trial and error period the machine learns to recognize the difference. In the case of sonar, Raytheon reports that the machine learns to sort real from spurious targets within several hours, an accomplishment that normally requires months for human sonar operators to learn.

When the machine makes a wrong decision, the spectral analysis of the recording is subtracted from the stored format in the memory. Thus when the Cybertron has completed its learning process, its memory does not contain the format of the signal it seeks to identify, but the difference between the signals it should identify and spurious signals which it should reject, according to Richard P. Witt, who heads the Cybertron program at Raytheon.

The K100 has been used to analyze electrocardiograms, to sort out normal from abnormal heart conditions, for sorting sonar and radar signals and other undisclosed military problems, company says.

The machine has been used to

The Grumman A2F-I

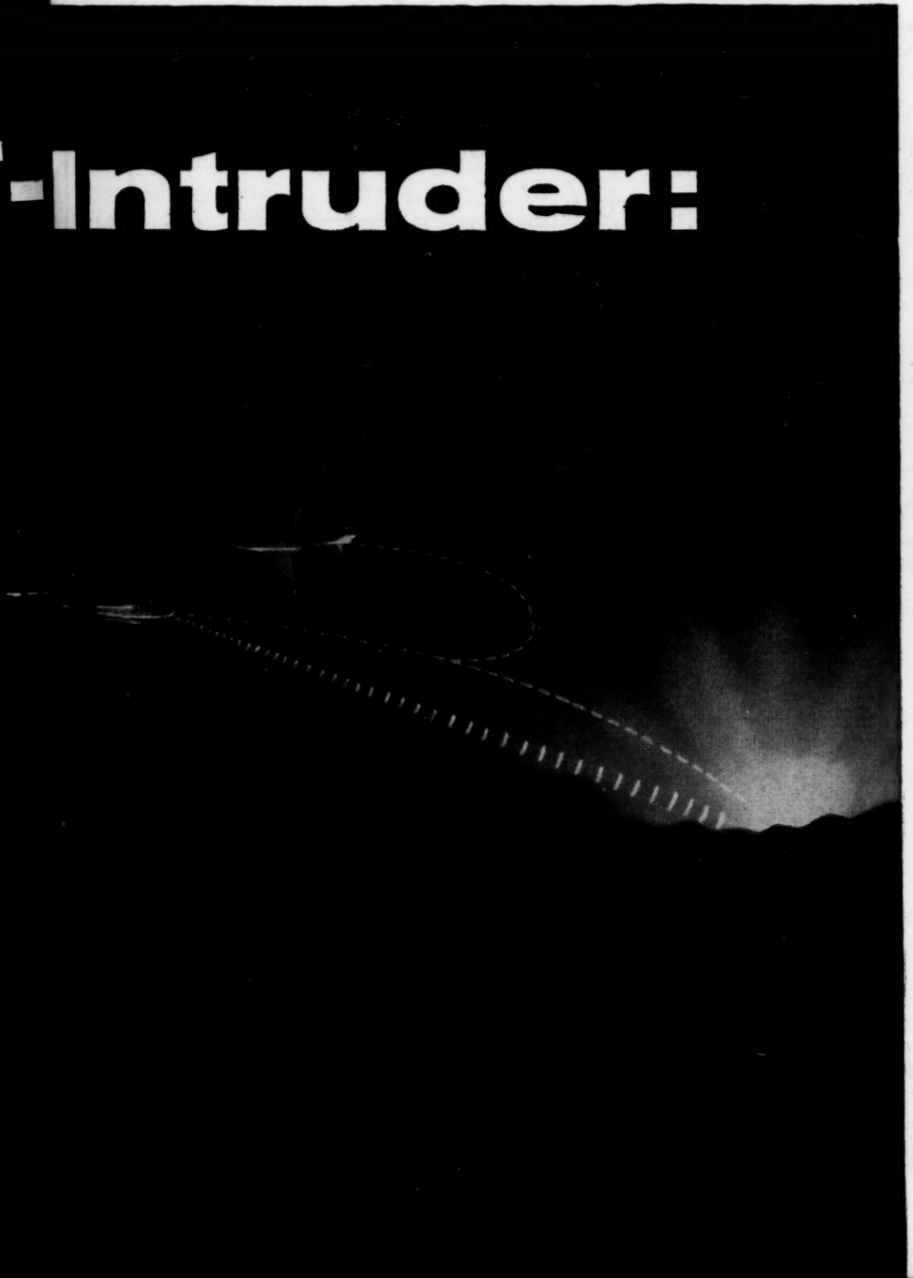


CYBERTRON, a machine that learns from experience and human instructors, can discriminate between submarines and whales in sonar recordings and perform other similar military functions, Raytheon says. First unit built is K100 (left) which uses punched memory tape. Larger, more advanced K200 (right), which uses magnetic drum memory, is designed to recognize human speech patterns.

design mis-matched filters for use in radars, for improved target discrimination, according to Witt. Raytheon predicts the machine might also prove useful in determining local weather forecasts.

Witt sums up the fundamental difference between the Perceptron and the Cybertron this way: "We have not attempted to duplicate the neural networks of the brain by electronics. Instead, we have duplicated the human learning process—experience, trial and error, correlation of new facts with past experience, and the use of a human teacher." The technique appears to bear some resemblance to the self-adapting filter, known as adaptive waveform recognition, developed by General Electric's Research Laboratory (AW Sept. 26, 1960, p. 83).

Raytheon has been working on learning machines for approximately 18 months. Original work was funded with company money, but Raytheon recently obtained government funding for portions of its efforts.



it "sees" through darkness and foul weather to search, track, and kill

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GENERAL METALS ACQUIRES AIRCRAFT PRODUCTS BUSINESS

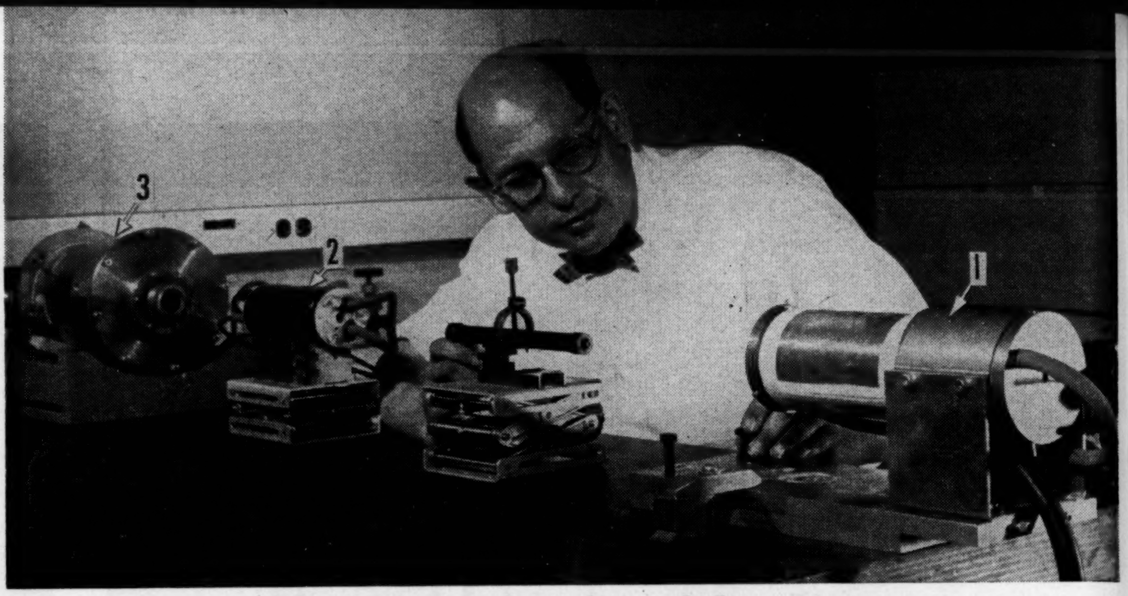
General Metals Corporation, Industrial subsidiary of Transamerica Corporation, announced today that it had acquired the Aircraft products business of Gladden Products Corporation, Glendale, Calif.

William E. Butts, General Metals' President, said the acquisition includes lines of hydraulic and pneumatic components for aircraft and missile, the production of which will be continued from the General Metals Adel Division Plant at Burbank, California. Technical and production personnel engaged in their manufacture at Glendale will continue that activity for General Metals at the Adel Plant.

The other subsidiary companies of Gladden were not included in this transaction, Mr. Butts said.

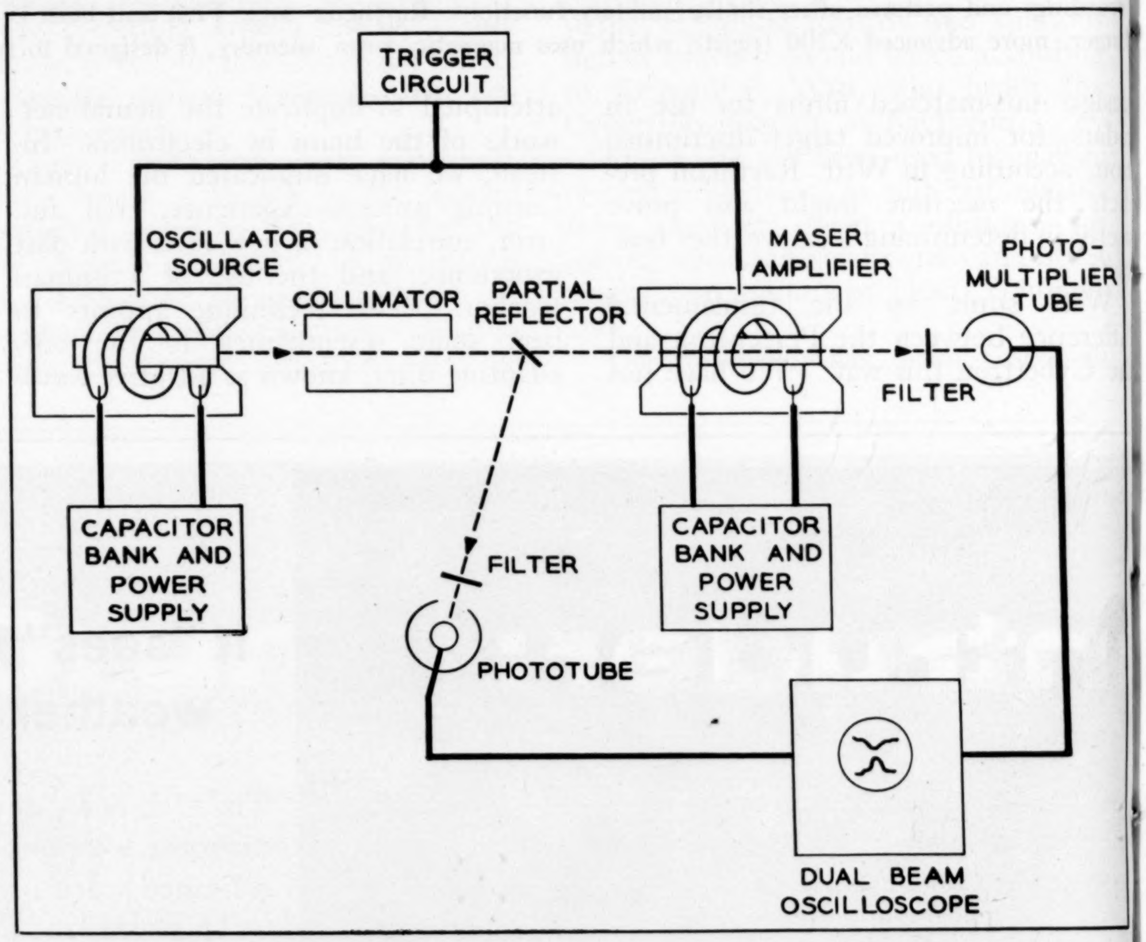
Adel Division of General Metals specializes in the design and manufacture of hydraulic, pneumatic, fuel and electro-mechanical systems and power generating packages for aircraft, missiles, rockets and ground support applications. Butts said the combined operation will continue to specialize in these fields, offering products which have been developed through the experience of each company during many years.

During the past eighteen months, General Metals has completed the enlargement of its facilities in Houston, Texas and in the San Francisco Bay Area has integrated the Enterprise Division with its iron and steel facilities in Oakland. The Company's Enterprise Diesel Engine Division at Oakland produces Diesel Engines for stationary power plant and Marine application.



Maser Light Amplification

Light amplification with a gain of 2:1 has been obtained by Bell Telephone Laboratory scientists using two pulsed ruby optical masers, operating at a temperature of −40C. Light from a conventional ruby opti-maser (1), operating as an oscillator, is beamed into second opti-maser (2) whose ends are not silvered (reflective) and its output is measured by a photomultiplier tube (3). Amplification (gain) is measured by comparing intensity of beam entering and leaving the second opti-maser. The gain obtained depends upon the temperature of the opti-masers and the pumping power, BTL reports.



FILTER CENTER

▶ **Saint Guidance Subcontracted**—Minneapolis-Honeywell's Aeronautical Division, St. Petersburg, Fla., is building an inertial guidance system, including an advanced digital computer and a stabilized platform, for the Air Force's Project Saint (satellite intercept) under a subcontract from Radio Corp. of America, Air Force prime contractor for final stage vehicle. Honeywell's Aero-Los Angeles plant will make a digital programmer, or intervalometer, which will permit more than a dozen functions to be programed into a Saint mission. Westinghouse is making a seeker for the vehicle's terminal guidance system.

▶ **Electromagnetic Research Ship Commissioned**—Technical research ship Oxford, a converted Liberty ship, which will be used by Navy as a mobile station for conducting electromagnetic propagation research, has been commissioned. The research ship also will be able to engage in hydrographic and oceanographic tests.

▶ **Shipboard Inertial System Proves Reliable**—North American Autonetics N7C inertial navigation system, used as an attitude reference on the USS Twin Falls Victory, Air Force missile-tracking ship, has operated for more than 3,000 hr. without failure, the company reports. The N7C is similar to inertial systems which Autonetics produces for Polaris submarines.

WHO'S WHERE

(Continued from page 23)

Changes

Norman Weinhouse, chief engineer, Kearfott Microwave Division, General Precision, Inc., Van Nuys, Calif.

Brig. Gen. Bernard M. Wootton (USAF, ret.), executive director of contract services, Page Communications Engineers, Inc., Washington, D. C., a subsidiary of Northrop Corp.

John D. Clair, director of marketing-systems and developments, Burroughs Corp.'s Defense Contracts Organization, with offices at Burroughs Laboratories, Paoli, Pa.

Houston D. Silliman, manager of Chicago (Ill.) area operations for American Airlines.

John W. O'Hara, head, Industrial Electronics Department, Systems Engineering Division, Aero Service Corp., Philadelphia.

Marcus C. Eliason, manager-customer relations, Electronic Communications, Inc., St. Petersburg, Fla.

Brooks T. Morris, special assistant for reliability assurance, Jet Propulsion Laboratory, California Institute of Technology, Pasadena, Calif.

Robert W. Bowman, director of product planning, Walter Kidde & Company, Inc., Belleville, N. J., and **John J. Beauvois**, assistant manager of the International Division.

Cecil Fiquett, in charge of Wyle Laboratories' newly established field engineering office in Huntsville, Ala.

Roswell P. Barnes, head of Melpar's Applied Science Division Physics Laboratory, Watertown, Mass.

Harold S. Tolley, program development manager, Cornell Aeronautical Laboratory, Inc., Buffalo, N. Y.

J. Lorentz, managing director of de Havilland Aircraft Co. of New Zealand, Ltd., succeeding **John A. Kerr**, retired. **Air Vice Marshal E. W. S. Jacklin** succeeds **Mr.** Lorentz as general manager of Hawker de Havilland (Pty.), Ltd., South Africa.

Theodore J. Nussdorfer, manager-aerospace systems research, Geophysics Corp. of America, Bedford, Mass.

E. N. Sizemore, head of the newly established Cocoa Beach, Fla., regional district office for Thiokol Chemical Corp., Rocket Operations.

Gary Himler, director of engineering, Computer Measurements Co., San Fernando, Calif.

Dr. N. L. Krisberg (USAF, ret.), assistant chief of technical staff, The Boeing Co.'s Aero-Space Division, Seattle, Wash.

Warren C. Dunn, military products marketing manager, Electro-Mechanical Division, Lear, Inc., Grand Rapids, Mich.

William D. McBride, director of information services, The Martin Co.'s Denver (Colo.) Division, succeeding **Don P. Herron**, now director of information programs at Martin's new Friendship International Airport (Md.) headquarters.

Republic Aviation Corp.'s Research and Development Center, Farmingdale, N. Y., has announced the following appointments: **Dr. Lorraine S. Gall**, specialist microbiologist, Space Environment and Life Sciences Laboratory; **H. C. Towle**, manager of the newly formed Systems Integration Section.

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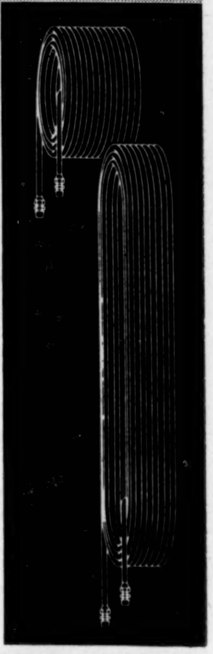

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CAB Accident Investigation Report

Blade Fatigue Cited in Chicago S-58 Crash

On July 27, 1960, at 2238 CDT, a Sikorsky S-58C helicopter, N 879, operated by Chicago Helicopter Airways, Inc., as Flight 698, crashed and burned in Forest Home Cemetery, Forest Park, Ill. The aircraft was demolished. The crew members and 11 passengers were killed.

N 879 arrived at Chicago Midway Airport from Chicago O'Hare Airport at 2215 CDT. It was serviced and scheduled to leave Midway at 2230 CDT, as Flight 698 for O'Hare Airport, 17 miles away. The flight departed on schedule in VFR weather conditions. All radio transmissions were routine.

When the flight had cruised to about the midpoint of its trip, a part of one of the main rotor blades broke away. The helicopter began to descend with its landing lights on. Sounds similar to the rapid cracking of a bullwhip were heard by witnesses. Moments later, the tail cone and tail rotor separated from the aircraft, and the angle of descent increased. The helicopter spun around its vertical axis—crashed nose-down on its left side—and burst into flames.

The Board determines N 879 became uncontrollable and crashed as a result of a structural disintegration in flight, initiated by a fatigue fracture of a main rotor blade.

On Aug. 3, 1960, the Federal Aviation Agency issued Airworthiness Directive 60-17-3, Amendment 191, Part 507 Federal Register, Aug. 19, 1960, which elaborates the inspection requirements of main rotor blades, and limits their service time to 1,000 hr.

INVESTIGATION

N 879 received a preflight inspection beginning before midnight on July 26, 1960, and was released by the night crew to the day crew at 0700[1] July 27, 1960. The helicopter remained in the hangar until repairs were completed on a main wheel brake and was then brought into operation at 1647, July 27.

Flight 698 was the seventh for N 879 on the 27th and there were no pilot squawks entered on the flight log. The operations consisted of trips back and forth between Midway and O'Hare Airports by a route 17 naut. mi. in length and over open areas suitable for autorotation landing, should an emergency require it.

The flight departed Midway at 2230 in accordance with company procedures. The cruising altitude assigned was 1,500 ft. above the ground. The weather existing at the time of the accident was: sky clear; visibility from 8 to 12 mi.; temperature 75 deg.; dewpoint 56 deg.; wind from the south 3 to 5 kt.; altimeter setting 29.93. Shortly after the accident, a helicopter pilot flying in the area of the accident scene reported the weather was clear and no unusual turbulence existed over or near the scene of impact.

The flightpath, established from the statements of eyewitnesses, indicated the helicopter was on course and at the proper altitude when first sighted. Those who observed the aircraft immediately before and during its descent said it appeared to be cruising in a normal manner. A sound similar to the cracking of a bullwhip was heard and the aircraft started to descend. The engine sounded to all witnesses as if it were backfiring and the whip-cracking sound continued. One observer stated the landing lights were on and the whole aircraft was rotating. Another witness saw the tail section break off from the helicopter as it was descending. None of the witnesses observed any fire aboard the aircraft until impact with the ground at 2238.

The wreckage covered an area extending 2,800 ft. in the direction of 315 deg. and 1,120 ft. wide. The cabin, powerplant, landing gear, main rotor mast, three complete main rotor blades, and about one-third of the fourth blade covered an area approximately 50 ft. in diameter.

The tail cone with the tail rotor attached was found back along the flightpath approximately 990 ft. from the main wreckage site. Scattered in a 500-ft. circle around the tail cone assembly were seat cushions, seat webbing, small pieces of fuselage structure, the cabin entrance step, and numerous pieces of fuselage insulation and paper. Farther back along the flightpath an additional 1,900 ft., the investigators found the outer 19 ft. of a main rotor blade lodged in a willow tree. This portion of blade matched with the part accompanying the main wreckage.

The blade had fractured 102 in. outboard from the center of rotation. There was no evidence of the fractured blade having hit any foreign object in flight. The fracture face on the part remaining with the aircraft was partially obliterated by ground impact, but the fracture face on the part that was found in the tree was unmarked.

Examination revealed the presence of a fatigue area which had its nucleus at the surface of the lower external back-wall radius of the spar. The fatigue had progressed up the back of the spar and 1.2 in. forward into the upper surface of the "D" shaped member. The fatigue had also progressed forward along the lower surface for about five inches. The fatigue zone comprised about 57% of the total cross-sectional area at the time of the final separation failure.

The failed blade, S/N 5434, was manufactured by Sikorsky in October of 1956. In June of 1958, when the blade had been in service 180 hr. and 40 min., it was subjected to a quickstart. The incident of the quickstart was described by the pilot who experienced it as follows: "As I started the engagement, I took the rotor brake off, turned the pump on and pumped oil into the clutch with the engine running between 1,200 and 1,500 rpm. . . . The main rotor had reached approximately 50 rpm. when there was a sudden mechanical lockage which induced severe torque on the rotor heads and blades. I had no control through the scissors being broken . . . The rotor brake, even though I applied it several times, had no effect on it, so there was nothing to do but . . . shut the engine off and let it coast to a stop."

All four blades were sent to the Sikorsky factory for repair. The 14 inboard pockets of blade No. 5434 were replaced at this time. In this replacement process the radius where the fatigue crack later started was refinished with a 240-grit paper and the new pockets were then bonded to the spar.

A review of the Sikorsky engineering drawing, from which the blade is manufactured, disclosed that all external surfaces of the blade spar were required to have a 40 RMS surface finish. Surface roughness measurements in the fracture area were made by Sikorsky after the accident, and these indicated the finish was within drawing specification. Similar measurements made for the Board by the National Bureau of Standards indicated that the surface finish was 50-60 RMS.

Blade Finish

Because the surface finish could have a significant effect on the fatigue life of the blade, the Board conducted a review of Sikorsky's quality control procedures relating to obtaining the required finish. The final finish on the external surface of the spar is achieved by use of an orbital sander. Until 1958, a 60-80 grit abrasive paper was used by the shopworkers to obtain the required 40 RMS finish. This grit paper was selected by the shop after evaluation as the proper grit to achieve the required finish. However, laboratory tests conducted after the accident showed that the actual finish achieved with this grit paper varied and was a function of the newness-oldness of the paper, the pressure applied by the sanding operator, etc. In fact, a 60-grit paper could be expected to produce a finish as rough as 110-120 RMS. This variability of surface finish, using 60-80 grit papers, was verified after the accident by examining the finish of other service blades produced at about the same time as the CHA blade. Discussions with shop inspection personnel revealed that the surface finish in production was judged on the basis of a visual examination and the inspectors' experience, and that, routinely, finish comparison blocks were not utilized.

In 1958, as a result of service experience with their S-56 blade, Sikorsky decided to incorporate as a product refinement, a finer finish on the back corner of their S-58 blades in production or overhaul. At this time the shop began using a 240-grit paper to obtain the desired finish. The back corner of the failed N 879 blade was refinished with this grit paper during the 1958 repair.

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[1] All times herein are central daylight based on the 24-hour clock.

In May, 1960, when the blade had a total time of 1,509 hr. and 29 min. it was again sent back to the Sikorsky factory for inspection and repair because of a reported vertical bounce condition. It was suspected that the blade was warped or deformed in some manner. During this repair no warpage or deformation was found, but three pockets were removed and replaced. However, the pocket at station No. 102, where the blade ultimately fractured, was not disturbed. The blade was again put back in service and had a total of 1,786 hr. and 6 min. service time when the accident occurred. (It had been approved for a service life of 2,450 hr. by the FAA.)

The fatigue crack started from an area of sanding scratches made from 60-80 grit abrasive paper used in the finishing process during original manufacture prior to bonding the pockets to the spar. The crack originated at one of these deeper scratches that was nearly perpendicular to the longitudinal axis of the blade.

Alodine Coating

In its original manufacture the blade spar was anodized. When the blade was repaired in 1958, after the quickstart, and again in May 1960, for suspected warpage, Sikorsky records indicated that an alodine coating was applied as required. Neither spot tests nor spectrochemical examination revealed any evidence of an anodized or alodine coating where the fatigue crack originated. However, subsequent tests and study disclosed that the post accident cleaning process applied to the spar prior to its examination had removed the alodine coating. Alodine was in fact present on the undisturbed parts of the spar that had been repaired in 1958 in the same manner as the fracture area.

Metallurgical examination of the failed blade disclosed that it had been fabricated from 6061-T6 aluminum alloy and that the material complied with the requirements of the pertinent Federal specifications. No evidence of corrosion damage was found, but minute corrosion pitting could not be eliminated since such pitting could have been masked by the sanding scratches. After the accident, when it was initially believed that the alodine coating had not been applied to the spar, Sikorsky initiated a series of fatigue tests in a corrosive atmosphere to indicate the effect of minute corrosion pitting and their tests are presently under way.

Chicago Helicopter Airways performs the following inspections on their aircraft: a daily preflight; a No. 1 every 20 hr.; a No. 2 every 55 hr.; a No. 3 every 105 hr.; and a No. 4 every 210 hr. The inspections are accomplished by a mechanic. Although the inspections cover many subjects, only that of blade inspection will be discussed here.

On the daily preflight and inspections Nos. 1 and 2, it is required that the mechanic: "Inspect main rotor blades for dents, scratches, cracks, corrosion, and damage to spar pockets and trailing edge." The bottoms of the blades, all of which are painted, are viewed by the mechanic with the naked eye while he stands on the ground or hangar floor. The tops of the blades are viewed by him as he stands on the transmission deck and looks down on the blades or as he

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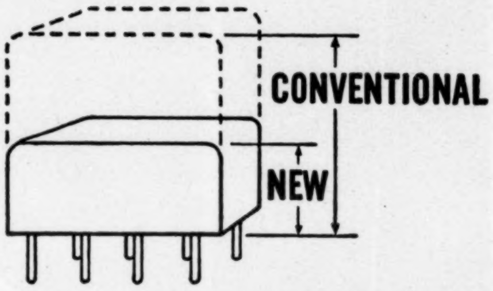

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stands on the floor looking inboard from the tip. From this latter position, a few feet of the top surfaces can be seen because the blades droop when they are not in motion.

On inspection No. 3, it is required that the blades be cleaned with a dry rag before being viewed for cracks, dents, etc. Prior to inspection No. 4, the blades are removed from the rotor head and placed on a stand and washed with soap and water. The company maintenance supervisor stated that the use of optical devices is not required unless something is found in the inspection that requires the use of a power glass to detect exactly what it may be.

All blade inspections had been performed on schedule. At 108 hr. and 11 min. before the accident the blade was given a No. 4 inspection, and 40 hr. and 2 min. later it was again removed from the rotor head, washed, and inspected, because the main gear box and rotor head were due for a change. On the previous day, three hours and one minute blade time before the accident, it was given a No. 3 inspection. At no time in the history of the blade were any cracks reported as a result of company inspections.

Teardown inspection of the powerplant was made. Aside from impact damage and ground fire, there was no indication of any failure of this component of the aircraft. The same was true of the transmission and clutch assembly.

The flight control system, electrical systems, hydraulic systems, and all auxiliary equipment showed no signs of having failed prior to the fracturing of the main rotor blade.

Blade History

Review of the maintenance records of blade No. 5434 disclosed that it had been installed on four different helicopters in its lifetime. It had been installed on N 879 on June 19, 1960, 156 hr. and 24 min. prior to the accident. Except for the quickstart incident, while installed on N 865, and the vertical bounce incident, while installed on N 866, no difficulties or unusual incidents occurred to blade No. 5434. Several vibration writeups were noted in the flight log of N 879 during the latter part of June and early July of 1960, but there were no further vibration writeups after July 17, when the tail rotor was balanced.

During the Board's investigation of this accident, a review of Sikorsky's rotor blade design procedures was undertaken to determine if these could have been involved in the premature fatigue failure.

N 879, a Sikorsky S-58C, was certificated by the Civil Aeronautics Administration in 1957 under Type Certificate No. 1H11 which lists as certification basis for approval of the type design, Part 6 of the Civil Air Regulations, dated Jan. 15, 1951, and Amendments 6-1 through 6-6. Fatigue requirements applicable to the main rotor-structure are presented in paragraph 6.250 of CAR Part 6, and a method of rotor service life substantiation acceptable to the Administrator is included in Appendix "A" to Civil Aeronautics Manual 6. Basically, the FAA (CAA) approved method correlates measured flight stresses, loading spectrum, and the fatigue strength characteristics of the structure, utilizing the Cumulative Damage Theory to arrive at a predicted fatigue life for the rotor. Further, a sug-

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gested loading spectrum is presented in appendix "A", and the minimum fatigue specimen testing for establishment of an S-n curve is outlined. In addition, the calculated fatigue life is reduced by 25% in arriving at the service life of the component.

In complying with the fatigue requirements of CAR Part 6, Sikorsky followed the basic CAM 6 procedure, including additional conservatisms based upon their own experience. Their initial 1956 analysis indicated an infinite life for the outboard portions of the blade (N 879's blade failed in the outboard area) and a service life of 2,450 hr. for the inboard portion of the spar. Accordingly, the blade retirement time was established at 2,450 hr. In early 1959, however, as a result of service experience with their S-56 blade, Sikorsky reevaluated the fatigue life of the outboard portion of their S-58 blade, utilizing new flight stress data and a lower S-n curve based on full-scale specimens. This analysis indicated that the fatigue life of the outboard portion was 4,560 hr. rather than "infinite" as calculated earlier; but since this calculated fatigue life was still appreciably greater than the fatigue life of the inboard spar, the service life of 2,450 hr. was not changed. At the time of the accident the service life of the S-58 blade was still 2,450 hr., and a number of blades had successfully accumulated its number of hours and had been retired.

Following the accident to N 879, Sikorsky made a fatigue calculation for the back corner of the spar at the spanwise location where the CHA blade had fractured. This reevaluation indicated that the spar at this location had a fatigue life of 4,690 hr., somewhat greater than the 1959 fatigue calculation—and still appreciably greater than the actual N 879 blade fatigue life of 1,786 hr. Still another fatigue calculation was made, using an estimated CHA spectrum, in the belief that their operation might be more severe than the conservatively modified CAM 6 spectrum. On the contrary, this calculation indicated a fatigue life of 5,960 hr., a value over three times greater than the actual life of the N 879 blade.

Since the original fatigue calculations and reevaluations of these calculations all indicated that the predicted fatigue life of the blade in the fracture area was appreciably greater than the actual fatigue life of the N 879 blade, efforts were directed at uncovering factors which would account for this large reduction in fatigue life. Specifically, studies and tests were initiated to evaluate the possible deleterious effects of (1) quickstarts, (2) service environmental conditions, (3) manufacturing variations, and (4) CHA's routes and operating practices.

Fatigue specimens were prepared and tested to determine if precompression simulating "quickstarts" had the effect of lowering the fatigue life of the rotor. All of the precompressed specimens tested to date have fallen within the S-n scatter band of the non-precompressed specimens, indicating no adverse effect. Fatigue testing of service blades which have been subjected to actual "quickstarts" is planned, but the results of the precompressed fatigue tests offer no great promise for the planned tests.

Early suspicion was directed toward the adverse effect of the surface finish on the fatigue life. As indicated earlier, the fatigue crack started at one of the deeper scratches in the surface made from 60-80 grit abrasive paper used in the manufacturing finishing process. However, fatigue tests of specimens finished with various grit papers disclosed no significant decrease in fatigue life for finishes within the range of manufacturing variation.

An investigation was initiated to determine whether the actual CHA S-58 operating spectrum was more or less severe than the spectrum used in determining the blade life. Much valuable data on loading spectrums were already available as a result of the NASA's continual helicopter V-g-h-n program; but specific data for CHA's S-58 operation had not been accumulated at the time of the accident. The NASA studies[2] show that the periodic loads developed in the various routine flight conditions constitute the principal part of the total fatigue loading on the helicopter, and that atmospheric turbulence and moderate maneuvers have no significant effect on the fatigue life. These research findings have a bearing on the degree of confidence that may be placed in the suggested CAM 6 spectrum. However, the N 879 blade failure raised the question of some possible peculiar loading condition in the CHA S-58 operation. Sikorsky installed, with CHA's consent and assistance, a V-g-h-n type recorder in a CHA aircraft and accumulated some 87 hr. of data under actual conditions. Preliminary evaluation of the data indicates that the CHA aircraft was operated substantially in accordance with recommended procedures, and that the CHA spectrum is not appreciably different from that assumed in the fatigue analyses. Sikorsky is also instrumenting one of their own aircraft to continuously record blade stress data and they plan to conduct a simulated CHA type of operation to further verify the adequacy of the design spectrum.

Soon after the accident to N 879, when it was established that the blade fracture was due to fatigue, the retirement or service life of the S-58 blade was reduced from 2,450 hours to 1,000 hours. In addition, the Board recommended to the Administrator that (1) a searching review be made of the approximate ten-year old CAM 6 design procedure, (2) CHA be required to conduct a more thorough visual inspection for cracks at all numbered maintenance checks, and that (3) as a precautionary measure all blades subjected to quickstarts be retired from service until such time as it is demonstrated conclusively that such a condition does not adversely affect the blade fatigue life. The Administrator has advised the Board that a revision of the CAM 6 design procedure is being studied; that a more vigorous blade inspection, as outlined in Airworthiness Directive 60-17-3, is being considered; and that it is his view that there is not sufficient justification at this time to require retirement of quickstart blades.

ANALYSIS AND CONCLUSIONS

Study of all operational aspects of this accident indicates that the aircraft was scheduled and flown properly. There were no radio communications of any unusual nature between ground stations and Flight 698, nor were any adverse weather conditions involved. Nothing would indicate that the flight had collided with any foreign object or that the captain and/or copilot mishandled the aircraft.

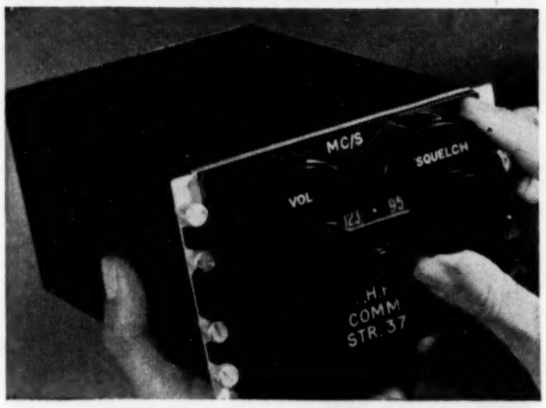
When the blade fractured, the main rotor assembly became unbalanced and vibrations of a sufficiently destructive force developed and caused the tail cone to fracture. This resulted in the complete loss by the pilot of control of the aircraft.

That the direct cause of this accident is metal fatigue of a main rotor blade cannot be doubted; and had this been the only determination that the Board had to make in its investigation of this accident the task would have been relatively simple. However, the prevention of similar accidents dictated uncovering all pertinent factors underlying the fatigue failure, and this larger task has been a most difficult one in this instance.

Reduced to its simplest form, the problem of achieving a satisfactory or "safe" fatigue life for a component such as a helicopter blade is a function of (1) design standards and procedures; (2) manufacturing standards and procedures, and (3) service conditions and practices. Adverse factors in any one or any combination of these areas can result in an unpredicted failure of the component. In fact, it is becoming more generally recognized that these factors are so intimately involved with one another that tolerable reliability requires the fullest consideration of their interrelationship.

As discussed previously, CHA's operation of N 879 was essentially in accordance with Sikorsky's general recommendations and as approved by the Federal Aviation Agency. Although preliminary evaluation of the recent Sikorsky flight history recorder data indicates no appreciable variations from the design spectrum, the Board believes this program should be continued to insure that there are no uncertainties in this important area. In this general regard, the Board is of the view that industry consideration should be given to installing flight history recorders on all newly introduced air carrier helicopters to verify design loading early in the fatigue life of the aircraft.

Whether CHA's blade inspection program was thorough enough to insure detection of the fatigue crack before the final fracture is a difficult question to answer. That these procedures were in accordance with Sikor-



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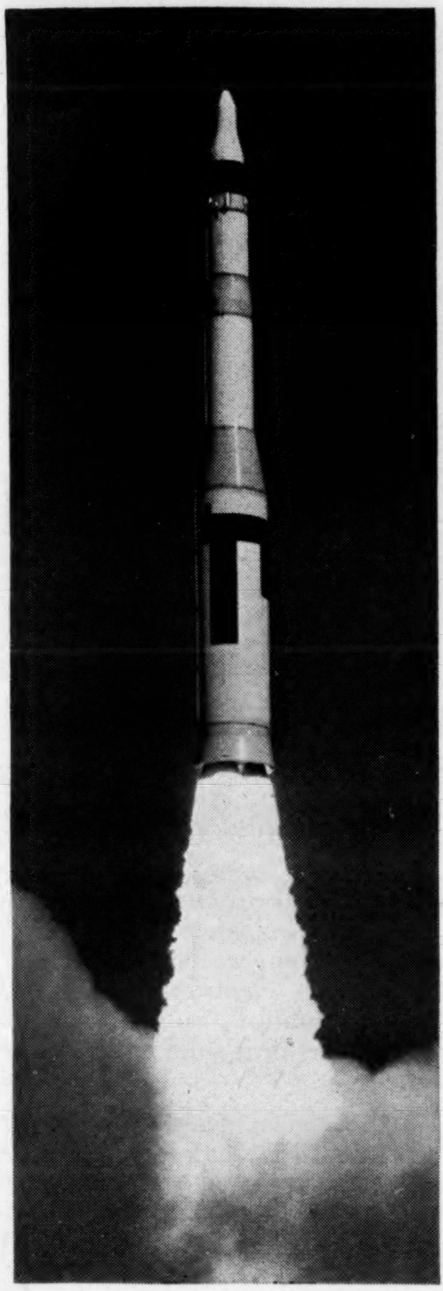
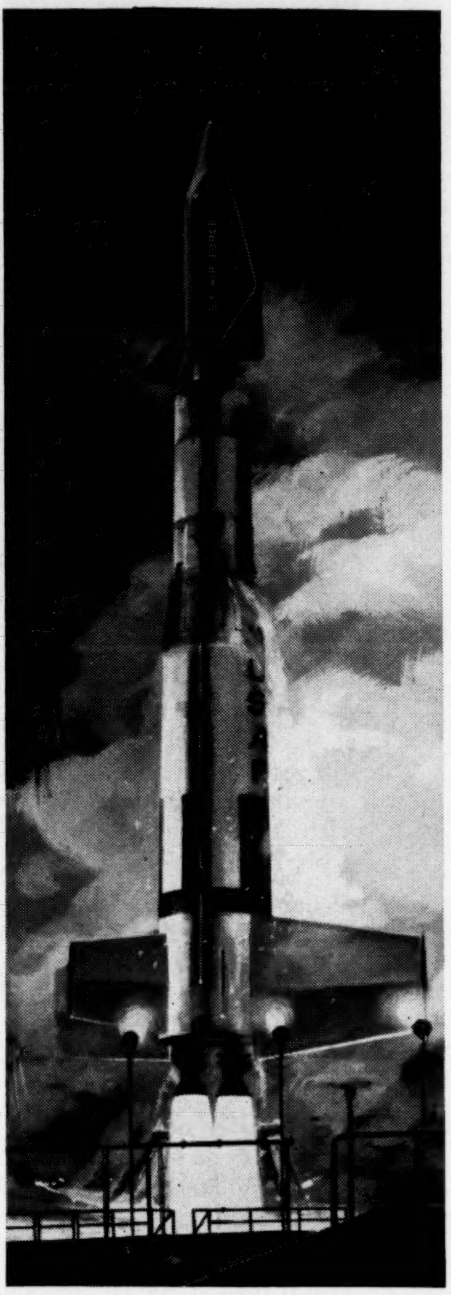
[2] NACA Technical Note 3434, 1955
NACA Technical Note 4203, 1958
NASA Technical Note D251, 1960





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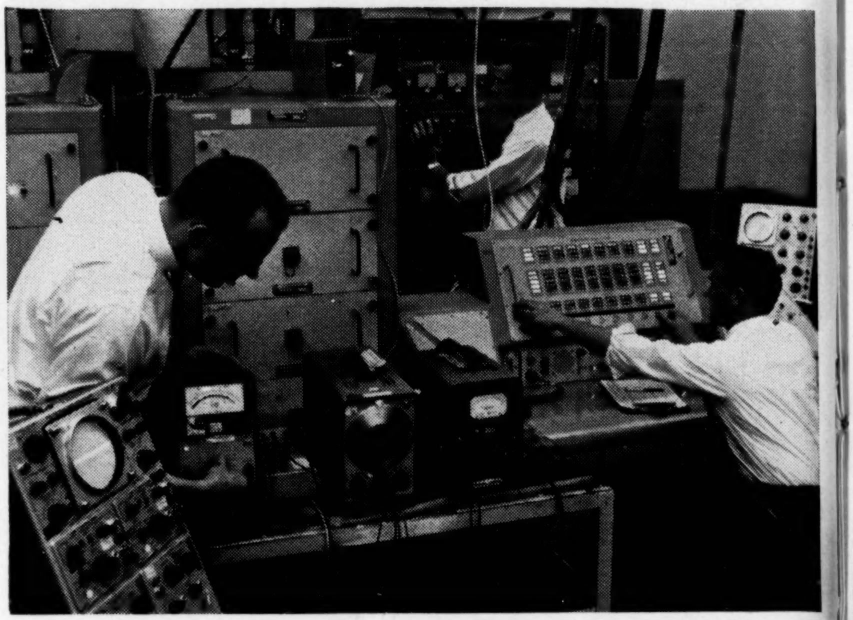

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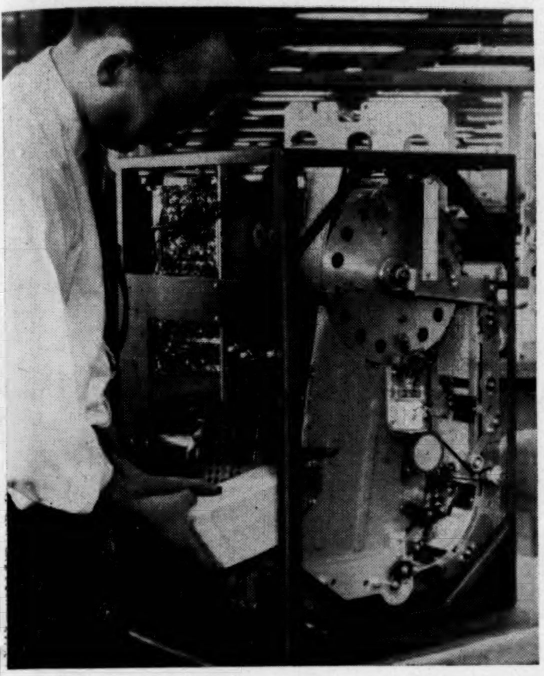

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sky's general recommendations and were approved by the FAA was clearly established during the Board's investigation. The lack of precision possible in assessing the time over which the crack developed and progressed to fracture contributes materially to the difficulty of evaluating the adequacy of the inspections performed. From the evidence developed during the investigation, it is the opinion of the Board that inspections of the type conducted by CHA during their numbered 1, 2, and 3 maintenance checks were not conducive to crack detection on the lower surface in the fracture area. Moreover, it is difficult to believe that a fatigue crack would not have been detected at the time the gear box was changed on July 13th—68 hours before the accident—if such a crack were present. This inspection, the equivalent of a No. 4 inspection, where the blades are removed from the helicopter and washed with soap and water before inspection, is considerably more thorough than the blade inspections during the Nos. 1, 2, and 3 checks, and most certainly would have uncovered a crack that had progressed beyond the pocket cutout.

However, it is more disturbing to consider that under the approved maintenance procedures, detailed inspections of the No. 4 check type occur at intervals of 210 hr. and that the July 13th inspection was only incidental to a gear box change. In other words, in the 2,450-hr. lifetime of the S-58 blade (this has since been reduced to 1,000 hr. as discussed earlier), a minimum of only twelve detailed inspections would have been permissible. In view of the catastrophic nature of a main rotor blade failure, as demonstrated by this accident, and the demonstrated fact that a fatigue crack can develop and progress to failure in less than 68 hr., it is the Board's opinion that the required detailed inspections of the No. 4 check type should be spaced at shorter intervals. In light of the foregoing, therefore, consideration should be given to increasing the frequency of detailed inspection as the service life limit is approached, or alternatively, and perhaps preferably, to integrate the inspection program in a design reliability analysis to achieve a desirable level of safety.

Although during the early stages of the investigation the surface finish in the fracture area was thought to be a major factor in the premature failure of the CHA blade, subsequent investigation tended to disprove this conclusion. The surface finish of the N 879 blade was not significantly rougher than as required by the drawing. In addition, other blades contemporary to the CHA blade had even rougher finishes and some had accumulated sufficient hours to be retired from service. Furthermore the design S-n curve, in effect, took into consideration these surface finish effects inasmuch as the fatigue specimens were finished in the same manner as production units. Finally, the fatigue testing done subsequent to the accident disclosed that surface finishes within the range of manufacturing variation fell within the S-n scatter band. For these reasons, the Board concludes that the premature fatigue failure of the CHA cannot be attributed to surface finish effects.

Corrosion Discounted

The question of corrosion figured prominently in the early considerations of the cause for the premature fatigue failure of the blade. Until the later tests discounted the earlier finding that no alodine was present in the fracture area, it was thought possible that minute corrosion pits, too small to be detected by metallurgical examination because of the roughness of the finish near the fracture, might have precipitated an early fatigue failure. However, the Board believes that it may reasonably be concluded that alodine was present in the fracture area and that corrosion pitting did not play any significant part in the failure.

Except for the refinishing of the back corner radius, without applying the specified alodine coating, the 1958 "quickstart" repair was in accordance with approved procedures and appears not to have been a factor in causing the subsequent blade failure. This last conclusion is borne out by the results of the simulated quickstart specimen testing which disclosed no deleterious effects from precompression of the amount that would be expected from a quickstart. The full-scale testing of service quickstart blades may alter this conclusion, but it appears doubtful at this time.

The remaining area in which the cause for the fatigue failure may be, involves the design standards and procedures. As discussed earlier, the fatigue substantiation methods used by Sikorsky were approved by the Federal Aviation Agency. Furthermore these methods, or ones very similar to them, have been in use in the industry for many years. Although fatigue failures have occurred before to various helicopter com-

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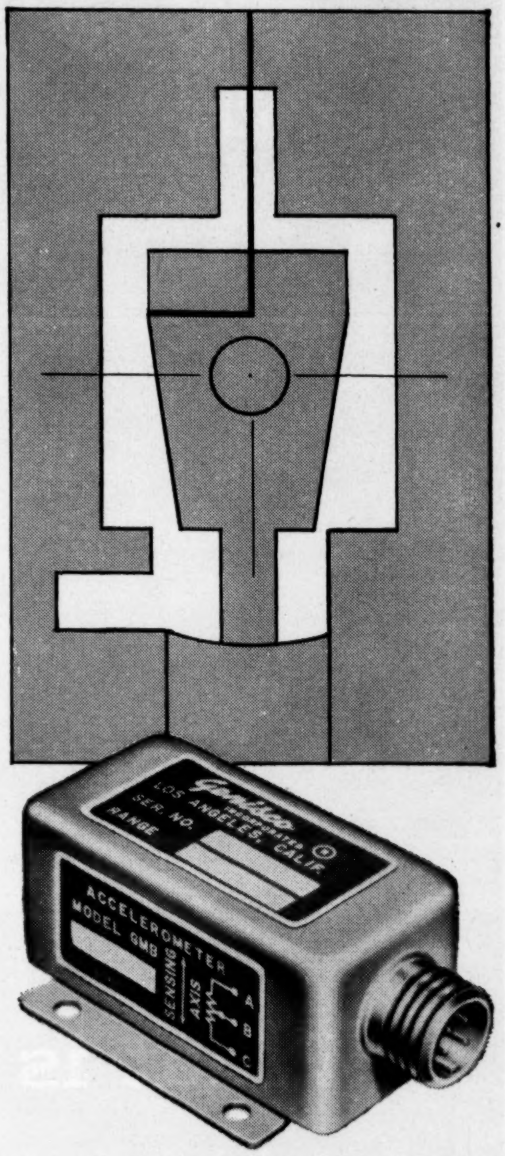

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ponents, including rotor blades, the failures could in just about every instance be attributed to factors not considered or foreseen by the designer in applying the approved methods or to factors relating to the service use or maintenance beyond the designer's direct control, such as operation outside of the recommended limitations, improper maintenance, etc. In the subject instance, the absence of such concomitant factors or, at least, the lack of conclusive proof that the existing factors (quickstart, corrosive effects, inspection techniques, etc.) contributed materially to the fatigue failure is reason enough, the Board believes, to question the conservatism of the approved design procedure. In this regard, extra margins, whether they be in the form of more frequent service inspections or in a more conservative design approach, should be required when the designer elects to use the "safe life" approach.

The Board is convinced that the facts developed during this investigation warrant detailed study by the industry and the Federal Aviation Agency so as to insure that proper conservatism is included in the design procedures for air carrier passenger helicopters.

PROBABLE CAUSE

The Board determines the probable cause of this accident to be the structural disintegration in flight, initiated by a fatigue fracture of a main rotor blade.

By the Civil Aeronautics Board:

Alan S. Boyd
Chairman
Robert T. Murphy
Vice Chairman
Chan Gurney
Member
G. Joseph Minetti
Member
Whitney Gillilland
Member

SUPPLEMENTAL DATA

The Civil Aeronautics Board was notified of this accident on July 27, 1960. An investigation was immediately initiated in accordance with the provisions of Title VII of the Federal Aviation Act of 1958. A public hearing was ordered by the Board and held in the Del Prado Hotel, Chicago, Ill. on Sept. 16, 1960.

FLIGHT PERSONNEL

Captain Robert Meyer, age 37, was employed by Chicago Helicopter Airways on June 25, 1951. He had 8,035 hr. total flying time; 2,380 hr. total flying time in S-58 helicopters, 1,333 hr. of which were at night. He had 203:45 flying time in the preceding 90 days, of which 63:04 were S-58 day, and 122:48 were S-58 night. He had flown 16:24 in the last seven days and 4:35 on July 27, 1960. Captain Meyer was checked out as captain on July 11, 1951, had flown three years and eight months over the route, and had practiced 51 autorotations, eight of which were at night, within the previous six months. He held ATPR No. 335518, with ratings in the Bell 47, S-55, and S-58. He held ratings for commercial, single-engine land, and flight instructor for airplanes and rotorcraft. The date of his last first-class medical was Mar. 14, 1960.

Copilot John Walker, age 25, was employed by Chicago Helicopter Airways on May 16, 1960. He had 1,015 hr. total flying time, 171 of which were S-58 day, and 10:45 night, with the company. He was checked out as copilot with the company on May 16, 1960, and had practiced 11 day autorotations. He had a commercial pilot certificate No. 1411365 with single and multi-engine land, instrument, and rotorcraft. He had flown 4:35 hours the day of the accident, 21:36 in the past seven days, and 71:02 in the last 30 days. Mr. Walker had a second-class medical dated May 16, 1960.

Chicago Helicopter Airways, Inc., is a Delaware corporation with principal offices in Chicago, Ill. This corporation holds a current certificate of public convenience and necessity for scheduled operations, and possesses valid air carrier operating certificates for these operations.

THE AIRCRAFT

N 879 was a Sikorsky S-58C; manufacturing serial No. 58420; date of manufacture was Jan. 11, 1957; and date of delivery to the company was July 2, 1959. It had first been delivered to New York Airways in January, 1957, then to Vertol Corp. in June, 1958. The engine installed was a Curtiss-Wright model 989C9HE2, reciprocating engine; serial No. 505014: TSO 68:09 and TT 300:17. The four main rotor blades had serial numbers and total time as follows: No. 7350, 2293:05; No. 6184, 457:18; No. 5434, 1786:06; and No. 10773, 1990:02.

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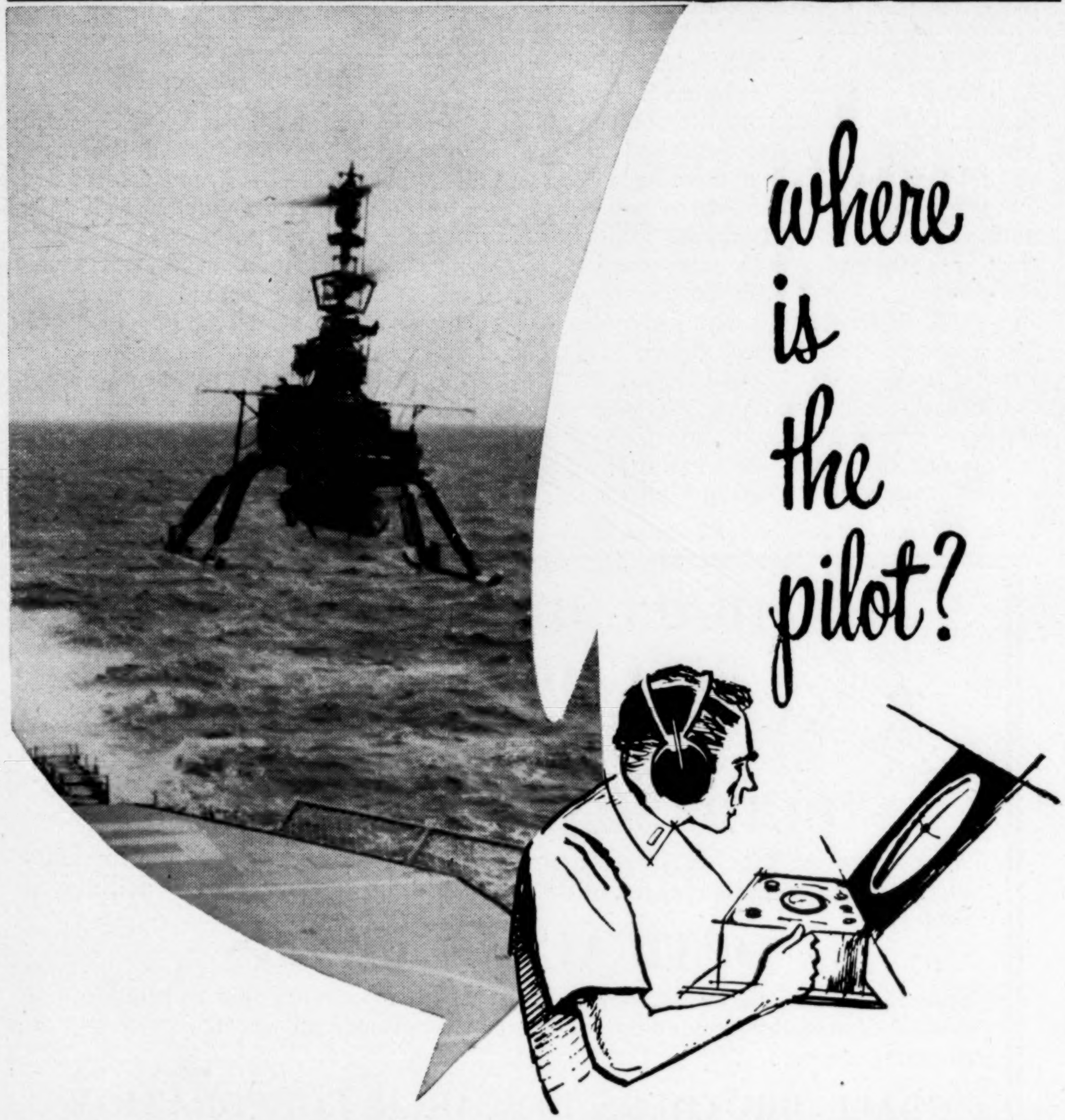
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AMERICAN AIR FILTER COMPANY, INC., DEFENSE PRODUCTS DIVISION.............. 62
AT ELECTRONICS, INC. 101
AUTONETICS, A DIVISION OF NORTH AMERICAN AVIATION, INC............ 12
AVIATION WEEK AND SPACE TECHNOLOGY...96-97

BALL BROTHERS RESEARCH CORPORATION... 111
BELL AEROSYSTEMS COMPANY, A DIVISION OF BELL AEROSPACE CORPORATION....3rd Cover
BENDIX ECLIPSE-PIONEER DIVISION, THE BENDIX CORPORATION................82-83
BENDIX SYSTEMS DIVISION, THE BENDIX CORPORATION.................. 56
BOEING COMPANY, THE.....................107-108
BRISTOL SIDDELEY ENGINES LIMITED.......50-51
BRITISH AIRCRAFT CORPORATION, THE.....73-76

CALLERY CHEMICAL COMPANY................ 58
CHERRY RIVET DIVISION, TOWNSEND COMPANY 65
CHICAGO AERIAL INDUSTRIES, INC............ 35

DOUGLAS AIRCRAFT COMPANY, INC........... 53

ELASTIC STOP NUT CORPORATION OF AMERICA, ELIZABETH DIVISION......... 5

FAIRCHILD CAMERA & INSTRUMENT CORPORATION, DEFENSE PRODUCTS DIVISION 3
FAIRCHILD STRATOS CORPORATION, AIRCRAFT & MISSILES DIVISION........... 16

GENERAL ANILINE & FILM CORPORATION, ANSCO DIVISION 15
GENERAL ELECTRIC COMPANY, LIGHT MILITARY ELECTRONICS DEPARTMENT...... 18
GENISCO, INC. 109
GOODYEAR TIRE & RUBBER COMPANY, THE—AVIATION PRODUCTS 7
GRUMMAN AIRCRAFT ENGINEERING CORPORATION 98-99

HAMILTON STANDARD DIVISION UNITED AIRCRAFT CORPORATION..........66-67

LAVELLE AIRCRAFT CORPORATION........... 79
LEACH CORPORATION 103
LEESONA MOOS LABORATORIES 13
LEWIS ENGINEERING COMPANY................ 95
LITTON INDUSTRIES, INC. 95
LOCKHEED AIRCRAFT CORPORATION.......... 20
LOCKHEED AIRCRAFT CORPORATION, GEORGIA DIVISION 111
LOS ANGELES DIVISION OF NORTH AMERICAN AVIATION, INC. 117

MAGNAFLUX CORPORATION SUBSIDIARY OF GENERAL MILLS CORPORATION.........70-71
MAGNETIC CONTROLS COMPANY 6
McDONNELL AIRCRAFT CORPORATION....4th Cover
MINNEAPOLIS HONEYWELL REGULATOR COMPANY, HEILAND DIVISION.............. 22

PARSONS COMPANY, THE RALPH M........... 14
PHELPS DODGE COPPER PRODUCTS CORPORATION....................90-91
PITTSBURGH DES MOINES STEEL COMPANY.. 17
PRATT & WHITNEY AIRCRAFT DIVISION, UNITED AIRCRAFT CORPORATION 46

RADIATION INCORPORATED 92
REEVES SOUNDCRAFT CORPORATION.......... 9
REICHERT FLOAT & MANUFACTURING COMPANY 101
REMINGTON RAND UNIVAC DIVISION OF SPERRY RAND CORPORATION............86-87
ROCKET RESEARCH CORPORATION............ 105

SCOTT AVIATION CORPORATION...............60-61
SHELL OIL COMPANY, AVIATION PRODUCTS... 44
SILICONES DIVISION UNION CARBIDE CORPORATION 24
SOLAR AIRCRAFT COMPANY 10
STANDARD PRESSED STEEL COMPANY........ 8
SUNDSTRAND AVIATION, DENVER DIVISION.. 11
SYLVANIA ELECTRIC PRODUCTS, ELECTRON TUBES DIVISION 48

TAPCO, A DIVISION OF THOMPSON RAMO WOOLDRIDGE INC. 64
TASK CORPORATION 78
TRANS SONICS, INC. 4
TRUEGER, PAUL M. 105

UNITED AIRCRAFT CORPORATION 104

VOI-SHAN MANUFACTURING COMPANY...2nd Cover

WESTERN GEAR CORPORATION, PRECISION PRODUCTS DIVISION 36
WESTINGHOUSE ELECTRIC CORPORATION, DEFENSE PRODUCTS GROUP 85

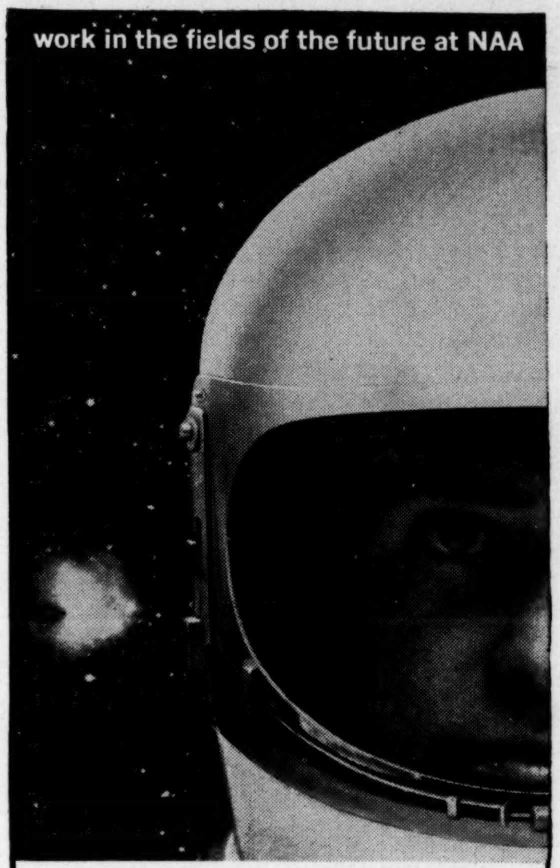
CLASSIFIED ADVERTISING

F. J. Eberle, Business Mgr.

WHERE TO BUY
  Mercury Air Parts Inc., Co...................... 116
EMPLOYMENT OPPORTUNITIES.............112-115
EQUIPMENT
  (Used or Surplus New)
  For Sale 116

ADVERTISERS INDEX

A & J Machinery Co.......................... 116
Ampower Corp................................ 116
Bausch & Lomb............................... 115
Boreas Corporation 116
Chance Vought Corp.......................... 114
Gyrodyne Corp. of America, Inc.............. 112
Lear Inc., Instrument Div................... 114
Lockheed-Georgia Co......................... 113
Minneapolis-Honeywell, Aero Div............. 114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LOS ANGELES DIVISION

NORTH AMERICAN AVIATION

LETTERS

Aviation Week welcomes the opinions of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Aviation Week, 330 W. 42nd St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

A Matter of Money

The call for American leadership in missilery and aviation by Murray Ogman of San Diego (AW Aug. 7, p. 114) will continue to be unheeded until we manage to place the people capable of such leadership in the government where the decisions are made. Premium salaries in industry attract the most qualified people out of government and into positions in which they cannot make decisions in the national interest. Put another way, how can you attract men qualifying in the $25,000-$100,000 range to $18,500 top jobs in the government?

J. Kenneth Lewis
College Park, Md.

German Mood

In your editorial of July 31 you publish some reflections about how the American people reacted against aggression in the past and surely will react in the future. There is no arguing about that, and the tenor of your general statement seems all right to me.

The only thing is that the source which provides you with the ideas about the German mood seems somewhat distorted to me. As far as I know, the German people had to learn quite a lot of different lessons by different teachers at different times, but it seems to me that most of them and especially those who have fought against Russia finally got the idea that they don't like a war at all and are pretty close to Bertrand Russell: Better red than dead.

Please remember that the German people didn't vote for rearmament and Chancellor Adenauer had to make use of some dirty tricks to get them started at all.

George H. Sichling, Ph.D.
Pacific Palisades, Calif.

Matching the Hordes

Your editorial of July 31 ends with three paragraphs containing greater delusions than any illusions which may be generated by the President's emphasis on building limited war capability.

On what basis do you make categorical statement: "We will never be able to match the Russian hordes on the ground using only conventional weapons." Are you perpetuating the myth that we are hopelessly outnumbered by the Communist bloc? A simple addition of populations will show that this is false in terms of the NATO powers relative to Russia and her European satellites. Gen. Maxwell Taylor in his book "The Uncertain Trumpet," cites estimates that NATO including the U. S. has 85.4 million fit males of military age vs. 58.4 million for the USSR and satellites. Similarly, Communist China, North Korea and North Vietnam are estimated to have 145.4 million in this category vs. 156.9 million in the pro-Western world excluding India, and the U. S. and the other NATO powers.

Furthermore, can you seriously contend, as you imply in these paragraphs, that invoking a nuclear war will be less costly of our "lifeblood" than was Korea? To ignore the inevitability that a nuclear attack on Russia would result in a counter nuclear attack on our homeland can only be a dangerous hallucination.

We shall have matured in the ways of national policy when we understand that a "swift and decisive victory" when synonymous with total or nuclear war is to reduce the idea of a war strategy to absurdity.

Richard Ripley
Brooklyn, N. Y.

Anti-Skid Devices

Re: Aviation Week, July 31, p. 37.
Correction on DC-8 anti-skid system.

This is to apprise you (and our readers, if you will) that the anti-skid system is bypassed when the emergency air brakes are used and is, therefore, effectively turned off.

When hydraulic emergency conditions exist such that it is reasonable to use the brake hydraulic system, the two brake system accumulators initially contain sufficient fluid for about five full applications and releases of the pilot's brake pedals; or, if the pilot uses discretion in the application of the pedals, the accumulators will be able to supply the fluid demands of the brakes when modulated by the anti-skid system during the braking run. In case the accumulator supply is depleted, the pilot can still resort to the emergency air brake system without anti-skid.

O. L. Wilkinson
Manager of Hytrol Systems
Hydro-Aire Co.
Division of Crane Co.
Burbank, Calif.

Medical Checks

In the letter "Pilot Medical Checks" (AW July 31, p. 112) an irate private flier seeks the answer to why FAA will ". . . continue the bureaucracy-at-any-price policies. . ." of some aspects of FAA's medical operation.

I've thought about this, and in a city where there is an abundance of facts, records, activity and new light, possibly an answer may be suggested by the case of a patient who was feeling fine but visited a doctor for a check-up. The doctor suggested an appendectomy.

In astonishment the patient said, "doctor, I've had an appendectomy, but if you can tell me one good reason I'll have another."

The doc said, "I need the business."

This, of course, could be an entirely inappropriate and unfair reason. So, I will follow a custom not established by FAA, and give something of the other side. The following appeared in FAA's "Aviation News" (May 1961):

"The Aviation Medical Examiner program came in for some criticism as did the instrument requirement for private pilots. In the majority of cases, however, the unfavorable comment was prompted by the inconvenience and cost to the individual concerned rather than to the rules themselves."

Incidentally, I just love the way that mixes one thing with another. But then why try to explain any more about "good reasons"? Didn't "Irate Private Flier" ever hear of the Federal Aviation Agency Act of 1958? There's a reason for you.

Robert E. Trimble
Washington, D. C.

Hijacking Rash

After the recent rash of hijacking of aircraft, Congress is proposing the death penalty for pirates and President Kennedy has stationed U. S. marshals aboard some aircraft. Furthermore, the latest hijacker (as of today), Mr. Albert Cadon, has been charged with assault and, I understand, efforts will be made to extradite him.

How come it took so long for the United States to decide hijacking of airliners was a crime? When the anti-Castro Cubans did it, it was treated as a big joke on Castro. When one of the Castro guards was shot, I don't recall any charges being levied against his assailant. And if the latest attempt to hijack a Cuban airliner had been successful, would the hijackers have been held for return to Cuba to face murder charges? Up to now only two American airliners have been hijacked by pro-Castro people, and in neither case was human life taken, albeit life was threatened.

Sen. Smathers went charging up Capitol Hill, his version of San Juan Hill, declaring war on Castro right and left and demanding immediate return of Eastern's Electra after it was taken. He has not proposed, however, the same time limit on the return of Cuban airliners, as it takes longer than 24 hr. to get a court order to attach and hold Cuban airliners.

It is about time we quit adopting the Communist ideas of flexible definitions and called a pirate a pirate, instead of a refugee when he comes here and a thief and a madman when he leaves here. Is there such a dearth of morality and ethics in our government that it cannot find means of combatting communism without adopting communism's methods, ethics, and moralities? If so, all that remains is the "mopping-up" operations; the main battle has been lost. It has been said, "You must fight fire with fire," however, when my neighbor's house is on fire I don't burn mine down to keep the fire from spreading. Neither do the firemen add gasoline to the flames; they use water instead. If we use Communist methods "temporarily" to fight communism, we might just wake up one morning to find them as "temporary" as the World War II and Korean War taxes.

J. N. Thilges
Cocoa Beach, Fla.